TROPICAL AGRICULTURE

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THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, ST. AUGUSTINE, TRINIDAD.

WOMEN STUDENTS.

ONE of the most astonishing developments of recent years has been the invasion, if we may use the word without an accusation of lack of sympathy with the movement, of all spheres of labour by women. Previously this movement was directed to the "professions," clerical, legal, medical and so on. Latterly the movement has been extended to other activities and now embraces such fields as had hitherto been considered to offer too strenuous an employment for women. Among these fields are included agriculture. With the impetus that is now being given to development of the tropics, with the essential agricultural basis of that development and with the large potential demand for trained persons which such development implies, it is only natural that the leaders of this movement should turn their attention to the possibilities of finding in tropical agriculture, a field for them to conquer. It is only natural too, that attention should be turned to the only present Imperial school definitely specialising in the teaching of tropical agriculture and that enquiries should be directed to the Imperial College of Tropical Agriculture as to the facilities it is prepared to offer to women. In its short life, the Imperial College of Tropical Agriculture has had no women students on its books for a complete course; there is as yet no precedent and that there may be no misunderstanding of the position, we propose to discuss the matter here.

Tropical agricultural development is of two kinds, dependent on the system of land tenure. In the older Colonies and in those possessing a climate sufficiently equable for Europeans to make a permanent home, the land has largely passed into the hands of Europeans, at times into the hands of development companies, at times into the hands of individuals. According to climate and to the nature of the crop grown, the unit may be large or it may be small and in many countries both forms may be found intermingled. It is difficult to forecast with certainty the future, but the whole present day tendency, at least where there is a resident native population, is in the direction of a second form of development which leaves land in the possession of the local populace and secures development through external bodies or corporations which provide the capital necessary for organised production through the agency of the local land owner. In these cases, as well as in the case of the land companies already established, it is a question as between employer and employee. The employer here has to be convinced that women are capable of fulfilling, under tropical conditions, the somewhat strenuous rôle now played by men. The employment of women is, in this case, a question of convincing business men of the efficiency of women under prevailing conditions.

In the more settled countries, where personal ownership is common, conditions are different. Family interests frequently enter into consideration and land freely changes hand. Here it is relatively easy to build up a home; if no family interests exist they can be acquired if the necessary capital is forthcoming. Given such conditions there is

no *a priori* reason why women should not enter the field, for they have shown their ability to do so under home conditions. It is a question of temperament and the only unknown factor is their ability to handle coloured labour. This, experience alone can tell, and the answer may, and no doubt will, differ with the individual and with the race from which the labour is drawn.

At the present time and particularly in technical institutions, the vast majority of students have in view their future life and the need for earning a livelihood. Any educational institution, if it is to bear the well-being of such students in mind, has a moral duty to see that only those are admitted who possess a reasonable prospect of finding employment after completing their course. It is morally bound, therefore, to enquire the objects which a student has in mind when making application for admission and, if not actually bound to refuse admission in unsuitable cases, it is at least bound to point out the attendant dangers so that the student enters with open eyes. That attitude we would adopt in this case. We recognise that, where there is family influence or capital or both combined, there is a field for women temperamentally suited for an open-air life and we would welcome women so equipped among our students; but the numbers so endowed with the good things of this world are probably few. The College cannot, on the other hand, influence employers or persuade them that the services of women in tropical agricultural development are economically efficient. The acceptance of such a view is necessarily a matter of slow growth and, until it is accepted, there is a moral duty incumbent on us to point out the facts to such applicants as, being without capital or influence, apply in the expectation that a course at the Imperial College will pave the way to profitable employment. To do otherwise would be, in our view, a breach of trust and neglect of moral responsibility.

COCOA IN BAHIA.

Government Supervision of Marketing.

WE understand from Messrs. Wessels, Kulenkampff & Co., that Bahia has recently passed legislation for the governmental control of the marketing of cacao. Official types or grades for exported cacao will be adopted providing that the exportation of cacao inferior to 'Fair' will be permitted only when the bags are conspicuously marked "Restlho." The mixing of 'Superior' cacao with inferior grades is to be prohibited. For cacao beans without any defects the qualification of 'Fine' may be added to 'Superior.' Four warehouses are to be erected at Bahia, each with a capacity of 50,000 bags of cacao. By the act all sales of cacao for future delivery concluded after January 1st, 1926, will have to be registered. The above regulations are regarded as the first steps towards the Government supervision, if not control, of the marketing of Bahia cacao.

COLONIAL FLORAS.

BY ARTHUR W. HILL, M.A., SC.D., F.R.S., F.L.S.,
Director, Royal Botanic Gardens, Kew.

THE publication by Sir William Thiselton-Dyer in the last number of the Kew Bulletin (*Kew Bulletin*, 1925, No. 7, page 289), of the history of the preparation and completion of the "Flora Capensis" suggests that an account of the work, which has been done and is being done at Kew, on the Floras of our Colonies and Dominions, may be of interest to readers of *Tropical Agriculture.*

The proposals for bringing out a series of Colonial Floras were put forward as early as the year 1863 by Sir William Hooker, then Director of the Royal Botanic Gardens, Kew, and the proposals which he put forward were for Floras of the South African Colonies in 10 volumes, the West Indian Colonies in 2 volumes, Ceylon 3 volumes, Mauritius and Seychelles 1 volume, British Guiana 2 volumes, British Honduras 1 volume, the West African Colonies in 2 volumes and British India in 10 volumes.

In the years that have elapsed since Sir William Hooker put forward his proposals many of his suggestions have borne fruit. The "Flora Capensis' has now been completed and occupies 10 volumes as originally proposed. The Flora of the British West Indian Islands was written by Grisebach in 1864 and occupies 1 volume. A Handbook of the Flora of Ceylon has also been published and occupies 5 volumes of text and 1 volume of plates, and the Flora of Mauritius and Seychelles occupies 1 volume. The Flora of Tropical Africa, representing Sir William Hooker's "Flora of the West African Colonies," now occupies 11 volumes and is not quite completed, while the Flora of British India has been published in 7 volumes. The Flora of British Guiana and the Flora of British Honduras, which were put forward by Sir William Hooker, have, unfortunately not yet been commenced. In addition to the published Floras certain ancillary publications have been produced at Kew; among the most important of these may be mentioned "The Useful Plants of Nigeria," which occupies a volume of the Additional Series of the *Kew Bulletin*, and a Flora of the West African Colonies is now in course of preparation. The importance of these Floras to our Overseas Possessions scarcely needs mention. To the botanist, of course, they are essential in arriving at a proper appreciation of the botanical resources of the Empire, and, seeing that one of the great needs of botanists of the present day is to accomplish a complete botanical survey of the Empire, any work connected with the Floras of our Overseas Dominions is of the first importance.

To the economic botanist a knowledge of the Floras is equally essential, as it is a matter of great importance that he should be able to determine accurately the plants which are of economic value. An exact determination of such

plants is of particular importance, for it is now realised that within a given species there may be distinct physiological varieties. As an example of this may be cited two cases of particular interest in the commercial world. One case is that of camphor, a product derived from *Cinnamomum Camphora* Nees, which is a native plant in Formosa and Japan. There happen to be two varietal forms of the camphor tree which are so alike in their external botanical characters that it is very difficult to separate them either in the field or in the herbarium. On distilling the wood, it is found that solid camphor is yielded by one variety, whereas from the other only camphor oil can be obtained, which is of little commercial value. These two varietal forms have only recently become known to Western botanists though they have long been known in the East. It now appears that the seed sent to our various colonies, Mauritius amongst others, must have been collected from the oil-bearing trees only and not from those yielding solid camphor, with the result that in Mauritius there is only about one tree yielding solid camphor. The same story could also be told of other colonies. Trinidad, however, is more fortunate, since there is a certain number of the true camphor-yielding trees in the island.

Another case of a somewhat similar nature concerns the Para Rubber, *Hevea brasiliensis*. A considerable variation exists in the amount of latex yielded by Hevea trees and it appears that trees yielding a small amount of latex tend to produce seeds more freely than those which are heavy-yielders. Not long ago when there was a large demand for rubber seed, seed was collected and sown without any enquiry being made as to the character of the trees from which the seed was gathered. In consequence it is now found that in many plantations there is an unduly large proportion of poor-yielding trees. A careful examination of a point like this by systematists and physiologists would undoubtedly have prevented a mistake which has proved to be a very costly matter. Further, the accurate scientific determination of a species is also essential in dealing with economic plants and especially when those yielding valuable fibres such as Agaves, Bromelias and Ananas, are under consideration. It is in such cases that a botanical institution like Kew, with all its varied resources, can afford real and effective assistance to large commercial industries connected with economic plants.

Returning to the subject of Colonial Floras and the Floras of the West Indian Colonies in particular, it is now well known that the Flora of Trinidad is much more akin to the Flora of the adjacent mainland of South America than it is to those islands to the north, while the Flora of Jamaica is very fairly distinct both from that of Trinidad and from the Floras of the Leeward and Windward Islands. Thanks to the efforts of Mr. Fawcett and the staff of the British Museum, the Flora of Jamaica is now nearing completion. The Floras of the Leeward and Windward Islands are, however, needing attention, since Grisebach's Flora is quite out of date and needs to be entirely revised and re-written. The Flora of the Colony of Trinidad and Tobago, owing, as has been said, to its affinity with that of the adjacent mainland of South America, needs a work of its own and it is greatly to be hoped that this will be forthcoming in the near future. A Flora of these islands is all the more needed now that the Imperial College of Agriculture has been established in the Colony. Not only will such a Flora be of immense value in connection with the courses of instruction given to the students at the College, but also to those engaged in the planting industries of the islands. A sound knowledge of the indigenous plants of a Colony is not only of interest to the botanist but is also a guide to the agriculturist, as, by a study of the weeds of the country, he is able to gain an insight into the nature of the soils and their suitability for those economic crops in which he may be interested.

Similar remarks apply to the Colonies of British Guiana and British Honduras. In these two colonies, however, the problems involved are somewhat different for in both these colonies there are, as is well known, great forests yielding very valuable timbers. In many cases our knowledge of the species yielding these timbers is very imperfect and it is impossible to develop any industry connected with timber until the trees have been scientifically determined. In the Herbarium at the Royal Botanic Gardens, Kew, there is a great wealth of specimens collected by earlier travellers and botanists who have visited Trinidad and Tobago, British Guiana and British Honduras, but it becomes increasingly evident, in working out various genera, that very much more material will be required before a complete flora of any one of these regions can be prepared. If, therefore, it should be decided to carry out the preparation of these particular Floras a great deal of additional work will be needed in the collection of specimens, and it is hoped this may be done by those stationed in the particular colony who are interested in its vegetation.

Though much can be done in the colonies concerned in the way of collection and provisional determination of specimens, the final preparation of the Floras can only be undertaken in a national institution such as Kew, where not only are the older type specimens of the Flora preserved, but also where the whole of the literature connected with such specimens can be consulted.

It is becoming more and more fully recognised how important it is to the agricultural and industrial welfare of any country that its botanical resources should be known as accurately as possible and it is to be hoped that every effort will be made by the West Indian Colonies to help forward the work of preparation of these Floras which are so urgently needed.

Subscriptions to *Tropical Agriculture* can commence at any time during the year.

ENEMIES OF BOOKS.

By SIR ARTHUR E. SHIPLEY, G.B.E., F.R.S.

Chairman of the Governing Body of the College.

(*The first part of this article appeared in our October issue (Vol. II. No. 10. pp. 223-224.).*)

THEN there is a mite, known as *Chyletus eruditus*, which though usually carnivorous frequently eats the paste which fastens together the pages of a bound book and so loosens the leaves.

Chyletus eruditus is a very combatant mite, and although it generally shuns its fellows when it meets them it seizes them with its very large maxillary palpi and devours them. Such weapons indicate a life of rapine; and, as Mr. Andrew Murray says, whoever lives by rapine must be solitary. They prey upon others and if kept in colonies gradually eat one another up. They were gregarious only until they had all been eaten up, but one. Then the last survivor resumes the solitary life which nature intended him to lead. Carnivorous animals such as lions and tigers, ravens and vultures, solitary bees and wasps do not live in communities, and this is true of the predaceous *Chyletus*. Apparently they have the power of poisoning their prey, as the latter becomes paralysed within fifteen or twenty seconds after being seized and then the contents of its body are sucked out leaving but a shrunken and empty shrivelled skin. The poison does not act on its own species for though *Chyletus* is frequently cannibal in its feeding habits, the prey in these cases continues to struggle until it has been destroyed. They are common enough in dust of hay, fodder and straw, in old chaff, in old meal, flour, linseed and are sometimes found on the human body. They live in the feathers and hairs of animals in museums. Though solitary they are very widely distributed. One curious fact should be mentioned. This species of mite is parthenogenetic as Mr. Beck has shown by numerous experiments. He succeeded in rearing three successive generations without the intervention of any male. The female lays eggs in a little heap and rests brooding over it guarding the eggs from attack. The brittle shell is very thin and reflects an amazingly blue light, which readily attracts the eye.

In the paragraphs printed above, we have in some cases mentioned the best methods of combating pests under the heading of the particular pest. The following paragraphs, however, deal with the methods of protection rather more widely. Mr. W. W. C. Dunlop writing from the Codrington College, Barbados, makes, in a letter published in *The Times Literary Supplement* of Thursday, November 13, 1924, the following appeal to bookbinders :—

Sir,

"May I through your columns make an appeal to British publishers and bookbinders? In this, as also, I believe, in other tropical countries, one's most treasured books are sooner or later riddled with tunnels by a grub, apparently the larva of a beetle. A volume not in daily use is almost certain to be damaged or destroyed. Various liquids are procurable which at least discourage these pests; but these do no good to delicate bindings, and not all are effective. But I have noticed that French and German bound books are absolutely immune. On these I never put any 'protective' solution, but they are never touched. I presume, therefore, that some ingredient—arsenic perhaps—is used by Continental but not by British binders.

It would be a great boon to book-lovers residing in the tropics to be assured of the safety of their treasures; to me personally it would mean the removal of a deterrent. There are few vexations more acute than to find a valued and perhaps irreplaceable volume marred and mutilated."

I have made careful enquiries both in Vienna and Paris, but cannot find out that the foreign printers or German bookbinders use any particular poison; but it may be that those who have been trying to help in this matter have failed in their quest.

H. N. Ridley writing in the *Sunday Times* tells us how to preserve books in the tropics from "worms."

"The answer how to preserve books in the tropics from 'worms,' is to paint the inside of the covers with a solution of corrosive sublimate in spirits of wine. It may have to be done again later, say in five years. The bookbinder should be instructed also to mix some corrosive sublimate in the paste he uses in binding. I have used this successfully in the East Indies for over twenty years."

The worst enemy to books in the tropics is the termite or white-ant. This creature lives in large colonies from which they start out to burrow. They are very frightened of any light. They will work through the legs of a table or the wood of any furniture, eating away the interior until nothing but a thin outside skin or veneer remains which on pressure collapses like a house of cards. In Cuba in order to avoid the ravages wrought by white-ants on books 100 c.c. of methylated spirits, 20 gr. of bichloride of mercury, and 15 c.c of phenic acid with enough shellac to produce a certain adhesive quality, is used. This mixture is lightly brushed over the book-covers. To prevent the access of the Termites to the bookcase the latter should never be placed against the wall and its legs should not touch a wood floor. There are libraries in India where the floors have been completely destroyed by white-ants, which have then attacked the bookcases.

In the *West India Committee Circular* for April 23rd, 1925, there is a short account of methods suggested by Mr. T. Snyder of the United States Department of Agriculture, on combating termites. But as his work is entirely devoted to timber and not to books, I will not do more than draw attention to the short article.

The only way to make the Libraries secure from the attack of Termites is to build the floor of stone or concrete. The Librarian of the Imperial Library at Calcutta tells me that they protect

their shelves by resting their supports in metal pans or basins which are kept full of a mixture made of a quart of kerosene, a quart of phenol, added to a bucket full of water. This also gives protection against the *Lepisma*. In India they also have their shelves wiped from time to time with a rag which has been dipped in a solution of naphthalene in kerosene, a quarter of a pound of the former to a quart of the latter, and occasionally they place naphthalene balls on the top of the books. They do not use corrosive sublimate, considering it would be dangerous in a public library, and the authorities at Calcutta do not regard corrosive sublimate as sufficient defence against the white-ant, which not only destroys the shelves, but will eat out the inside of thousands of books, and do it almost in a night. Sir Norman Lamont tells me that he has successfully preserved his books by using a solution of—

corrosive sublimate ..	..(1 oz.)
carbolic acid	..(1 oz.)
methylated spirit	..(1 pt.)

This solution is painted on the outside and inside of the covers and the brush is passed down the inside of the back. The gilt lettering should be avoided. The Librarian in Calcutta writes that a Library will often stand thirty years without exhibiting any great signs of decay, yet in the following half-century the whole thing may almost disappear. But the worst damage suffered in India is the perishing of the paper. It cracks into pieces bigger than postage stamps, and the fissures are irregular but extremely clean-cut. The very poor quality of paper that is now in use to some extent explains this, but exactly how and why it happens one really does not understand. The real remedy to keep books fresh and free from damage is to have the library in a building in which the temperature and humidity can be regulated. Such a building exists in the shell-filling factory at Dum-Dum, but its cost would probably be prohibitive in the rather starved libraries of our centres of learning in the tropics.

Eighteen years ago when Lord Elgin was Secretary of State for the Colonies, Dr. T. Thorpe, F.R.S., then Principal of the Chemistry Government Laboratories, made the following suggestions for combating the injury frequently caused to official records in tropical climates by insects and other animal pests.

"In 1888 the British Consul at Swatow called attention to the frequent injury to books which occurred in China, and quoted a remedy which he stated was quite effectual in preventing such ravages. The recipe which he gave for this preparation is as follows, *viz.*:—corrosive sublimate 5 drachms, creosote 60 drops and rectified spirit 2 lb.

This is an alcoholic solution—methylated spirit or rectified spirit would equally serve—containing approximately 2 per cent. of mercuric chloride and one-half per cent. of creosote. The directions for use were:—Apply with a brush in the joint of the book between every six or seven pages and in binding add a little of the solution to the glue used, whilst to protect the cover from cockroaches, apply to the cover a thin, clear spirit varnish.

Such a preparation I should expect to prove satisfactory; and it is noteworthy that among the replies received to the enquiry of the Governor of the Bahamas, decided approval is expressed of a preparation of 'corrosive sublimate, carbolic acid and methylated spirit,' which is very similar to that given by the Consul at Swatow.

For the preparation and use of such a solution the following instructions may be given:—Dissolve 5 grams of corrosive sublimate (mercuric chloride) and 60 drops of wood creosote in two pints of rectified spirit (or methylated spirit).

In binding books, a little of the solution should be added to the paste and glue used and the liquid should be applied with a brush to the back of the sewn book before it is fixed in the covers, to the inside of the leather or cloth, and to both sides of the millboard used in preparation of the covers.

For the preservation of books that are already bound, the liquid should be applied with a fine brush to the joint of the book between each 'sheet' of which the volume is composed and as far as possible to the sewn back of the book inside the cover. In both cases there can be no objection to the application of a thin spirit varnish to the finished covers in accordance with the recommendation already quoted.

With regard to the treatment of books and papers for the destruction of insect pests with which they may be already infested, the evidence available is in favour of carbon bisulphide. This appears to be effective and it has the merit of spontaneously volatilising even at ordinary temperatures with of course increasing readiness at tropical heat. If an entire room is to be treated, the articles should be lightly disposed so that the carbon bisulphide vapour may reach everything and all parts, *i.e.*, books should be taken from shelves, stood on edge and half opened; bundles of papers should be untied, and opened out as much as possible; book-cases should, if possible, be moved from the walls, &c., &c. Finally all fire-places, doors, windows, keyholes, cracks and crevices in connection with doors and windows should be closed by being pasted over and then, before finally closing it up, liquid carbon bisulphide should be placed in open vessels in various parts of the room, which should then remain closed for at least 12 hours. When the room is again opened it must be remembered that carbon bisulphide vapour forms, like coal-gas, an explosive mixture with air, and no light must be brought near until doors and windows have been opened for some time and all smell of carbon bisulphide has disappeared."

Dr. Thorpe also suggested a method of clearing small objects from 'pests' by exposing them to the vapours of liquid carbon bisulphide enclosed in a box: separate books, or bundles of papers can thus be treated without closing the library. He adds:—

"In all cases the inflammable character of carbon bisulphide vapour should be borne in mind and no light be brought near where this substance is in use.

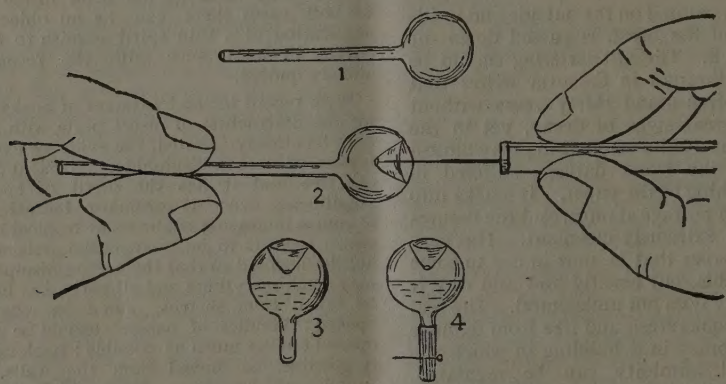
As a general protective of books, papers, &c., no better substance than naphthalene can be recommended. This substance can be placed in bookcases, presses, cupboards, boxes, &c., without injury to the books or papers and has the

advantage of being a solid which volatilises but slowly and so needs to be replenished only at comparatively long intervals."

Since writing the above, I have come across a method for controlling insects and fungi by the use of creosote. These paragraphs have been taken from Mr. M. E. MacGregor's article on "The Special Apparatus and Technique of the Study of Mosquitoes and Other Aquatic Insects" (*Parisitology*, Volume XVI, No. 4, 1924), with his kind permission.

Special creosote bottles for storage boxes.—Naphthalene which is so often used in entomological storage boxes to preserve the contained specimens from the destructive attentions of other insects fulfils this function fairly well in temperate climates, but in hot weather, and particularly in the tropics, naphthalene volatilizes rapidly and has to be frequently renewed. In addition naphthalene has little or no control over the growth on the specimens of fungi which in the tropics are more destructive to collections than even the small insect pests. Creosote, in place of naphthalene, safeguards the collections both from fungi and insect pests. As creoste is a liquid, however, its application to the storage boxes has involved difficulties. Special safety bottles are made which may be placed in the storage boxes, but they are often difficult to obtain, and most types are somewhat cumbersome. Pieces of cotton wool are often pinned into the boxes, and a few drops of creosote poured on to the wool, but this is a most unsatisfactory method as the creosote is apt to spread on the inner surface of the box and cause a very untidy appearance.

I have found that neat and thoroughly serviceable creosote bottles can be made without difficulty from glass tubing. If pinned into one corner of the boxes these bottles take up very little room, and do not spill their contents, no matter in what position the box is placed. The bottles are made in the following way :—



DIAGRAMS.

Method of the construction of the special creosote bottles. 1, glass tubing with bulb blown on one end. 2, depressing the softened under surface of the bulb. 3, the tub cut off from the tube, sealed, and filled with creosote. 4, rubber tubing and pin attached ready for insertion in the specimen box.

Obtain a piece of glass tubing about $\frac{1}{4}$" in internal diameter. Seal one end by revolving it in a gas or paraffin blow-lamp flame, and when the lumen has been completely closed heat to a bright red colour, and, by blowing carefully down the open end of the tube, form a spherical bulb about $\frac{1}{2}$" in diameter. Allow the glass to cool and transfer the glass tube with the bulb at one end to the left hand. In the right hand take a mounted dissecting needle and bring the upper surface of the bulb carefully into the flame once more until the glass softens. Then remove the bulb from the flame, and rapidly, but with a steady pressure, strike the softened glass exactly in the centre with the point of the needle, and press the glass inwards until the point of the needle reaches to the centre of the sphere. This results in the formation of a semi-spherical bulb with an invaginated centre, similar to the familiar safety ink-pot.

Allow the glass to cool and with the needle carefully break through the glass at the middle of the depressed centre, forming a hole about $\frac{1}{16}$" in diameter. Now cut off the bulb from the glass tubing, leaving about 1" of tube attached to the lower end of the bulb, and seal this end of the tube by revolving it in a flame. Over the sealed end of the tube a small piece of rubber tubing is slipped, leaving $\frac{1}{4}$" of the rubber tubing extending beyond the sealed end of the glass. Half fill the bottle with creosote by means of a capillary pipette whose end will enter the hole in the centre of the bulb, and the bottle, lying on its side, may then be pinned through the rubber into one corner of the box. These bottles have been found to act admirably: the creosote evaporates rapidly enough to preserve the specimens perfectly, although one charge of creosote will last for more than a year.

(*Concluded.*)

COTTON FUTURES.

THE following announcement has been sent out by the Liverpool Cotton Association :—

"A general meeting of the members of the Liverpool Cotton Association has adopted a new form of futures contract, entitled "The Empire and miscellaneous cotton delivery contract," against which all growths of cotton not lower than the grade and value of strict low middling American cotton may be tendered, the contract only excepting certain grades of Egyptian cotton tenderable on the present Egyptian futures contract. Thus, a hedge in the futures market is provided for growers and importers of Empire cotton, which, it is hoped, will greatly benefit Empire cotton-growing. The formulation of this contract is the result of a long series of special committees and meetings of the directors of the Association, who have been giving very earnest consideration to this most important matter."

The general purposes, functions and methods of working of futures contracts are so imperfectly understood that we have pleasure in publishing the following article by A. Bryce Muir, Esq., Ex-President of the Liverpool Cotton Association. This article was specially written by Mr. Muir at the request of the Editor of the *Empire Cotton Growing Review* in order to give growers and others, to whom a detailed knowledge of the subject is not essential, a general idea, expressed in non-technical language, of the objects and operation of a futures contract.

COTTON FUTURES CONTRACT.

A. BRYCE MUIR,
Ex-President, Liverpool Cotton Association.

The first purpose of the Liverpool Cotton "futures" contract are to protect those engaged in the industry, mainly as merchants, distributors and manufacturers, against violent fluctuations in price. They can insure, or protect themselves, against appreciation or depreciation by buying or selling cotton for "future" delivery to the weight of their forward commitments.

All the world use cotton goods. The amount they require may be influenced by high or low prices, political peace or disturbance, by the fluctuations in the volume of their trade. In other words, the volume of demand varies widely from time to time.

Cotton is a delicate plant; it is liable to many climatic troubles in its career, and it is liable to serious damage from insects. Consequently, the volume of raw cotton produced varies widely from year to year.

The result of this wide variation in supply and demand is wide fluctuations in price.

The "futures" markets have become a beautifully balanced machine which reflects the world's cotton conditions and requirements. The ruling prices of "futures" from day to day, and from hour to hour, govern the market price of raw cotton all over the world.

The Liverpool Cotton "futures" contract calls for 100 bales of 48,000 lb. weight of American cotton. The basis of the contract is the average grade of the average American crop (Universal Middling Standard equal to Liverpool Fully Middling). The cotton must be delivered in Liverpool during the month for which the contract calls, and there are very detailed rules and regulations governing this fulfilment of the contract. All contracts are subject to the Articles and Rules of the Liverpool Cotton Association. Sellers may deliver better cotton than the quality called for, or cotton of less value (with a stipulated minimum). The buyer must take the quality tendered at its relative value on the day of tender. This value is determined by professional arbitrators, with appeal to a committee of specialists elected for the purpose. By making the basis of the contract the average grade of the average crop, it is felt to be fair to both buyer and seller.

A spinner wishing to buy a given quantity of cotton per week, for three months ahead, against a sale of yarn over a similar period, can, on fixing the price of his yarn, buy an equal weight of cotton for future delivery in the months he requires it; thus he is independent of any fluctuation in price, for he has based the price of his yarn on the price at which he could buy his cotton for future delivery.

When each month comes round, he can sell out his future delivery contract and simultaneously buy the particular quality of raw cotton he requires, basing his purchase on the price at which he sells his "futures" contract. If the market has meanwhile advanced, he pays the advanced price for his quality of raw cotton, but as his "futures" contract has also advanced, the profit he makes on it goes to reduce the amount he pays for his raw cotton. Similarly, should prices decline, he buys his raw cotton at a price relative to the decline, but adds to the price the loss incurred by his purchase of "futures." Therefore, so long as he transfers his "future" contract into an equal weight of the particular quality of raw cotton which he requires, at the price ruling at the time, he has been able to eliminate intermediate fluctuations.

Merchants who import cotton similarly "hedge," or protect themselves against fluctuations in price, by selling an equal weight of "futures" at the time they purchase their cotton. When they sell the raw cotton, graded and selected for the particular requirements of various spinners, they simultaneously buy back their "future" contract sales; or they may sell cotton for delivery ahead over several months to a spinner, at a fixed price, and they protect themselves by buying "futures" of an equal weight, selling out their "future" contracts as they purchase the particular qualities of the raw cotton they require. These are two simple illustrations of the principle of "hedging

with futures" as a protection against fluctuations in price. All branches of the "trade" are in the habit of "hedging" and so markets become active and free.

It is obvious, however, that it is imperative that one should be able to buy and sell "futures" contracts freely and at a "close" price if hedging is to be satisfactory. . . . This free trading is provided by professional operators who spend a strenuous life in providing such facilities—not out of public spirit (!) but as a means of livelihood. There are jobbers, as on the Stock Exchange, dealers, who buy when they think the market is too weak and sell when they think it too strong, and straddlers, or arbitrage operators, who watch closely the relative values of the New York, New Orleans and Liverpool "futures" markets, by their operations keeping them in relation to each other. Speculators buy when prices are down too low, in their opinion, or sell when too high.

Fluctuations are based on pence and hundredths of a penny per lb. In normal markets one can trade quite freely within $\frac{1}{100}$th of a penny per lb. A jobber will offer to buy, say, 100 bales of cotton 48,000 lb. weight at $17\frac{25}{100}d.$ per lb., or sell a similar quantity at $17\frac{26}{100}d.$ per lb. One could hardly wish for closer trading. It seems that on a contract worth £3,450 a jobber will make a price within £2. He is willing to buy at £3,450 or sell at £3,452. This illustrates the extraordinary freedom of trading in "futures" as a result of all the trade using "futures" as a hedge for their transactions.

Other trades are now developing trading in "futures," for they realize that by eliminating the risk of price fluctuation business can be cut to very fine margins of profit and the turnover enormously increased.

NEW YORK COCOA EXCHANGE.

WE understand that New York has set up its own Cocoa Exchange with the objects of facilitating trading in cocoa and avoiding the great fluctuations in prices and injurious speculation which have hitherto been experienced. The operations of the Exchange will be assisted by the establishment of its own Clearing House. It is suggested that a revenue should be secured by a tax of say, 15 to 20 cents on every contract cleared in return for the services rendered. A contract will consist of a minimum of 30,000 lb. for which margins will be called by the Clearing House. It is considered likely that most members will prefer to have their contracts carried for them by brokers on account of the small charge made for the service. The Exchange was due to begin functioning on October 1st. Of the 150 seats available all, with the exception of 14, were sold by September 15th. The values of these remaining seats have been fixed as follows: 4 at $3,000; 5 at $4,000 and 5 at $5,000. The eagerness with which the United States of America and foreign interests have purchased seats augurs well for the future of the Exchange.

NEW BERRIES.

Promising Experiments in Porto Rico.

By J. P. GRIFFITH, Plant Breeder,
Insular Experiment Station, Rio Piedras, Porto Rico.

[*The following article is reproduced from the "Porto Rico Progress" and has more than local interest apart from the merits intrinsic to Rosaceae fruits themselves. In all fruit producing countries there is a larger or smaller amount of second grade fruit, and the prosperity of the trade is bound up with the disposal of this. Such fruit can be preserved, but in many of these cases the preserved fruit is of low value. The orchard problem, in such cases, is to find a ground fruit of a merit which in combination, will raise the market value of the preserved. Such a ground fruit is most likely to be found among the Rosaceae.*]

DURING the past two years the Insular Station has been searching in various parts of the world for tropical forms of raspberries and blackberries. We have now brought together a collection of species, some of which produce such valuable fruit in their wild form that they have been brought under cultivation in certain parts of the tropics. Other species are promising from the standpoint of hybridization. When one considers that practically nothing has been done to improve tropical Rubi so that they may be used for cultivation in regions to which they are best adapted, we are fortunate indeed to possess as many distinctly good forms as now exist. It seems that some tropical Rubi develop a rank plant growth at the expense of good fruiting characters.

In northern countries, the breeding and development of raspberries and blackberries has been under way for many years and while there are now many excellent standard varieties in the trade, the Experiment Stations and nurseries are constantly introducing new varieties which are superior in one respect or another to varieties already under cultivation. For example, the matter of breeding for disease resistance is one of the promising lines in the improvement of raspberries. The black raspberry is very susceptible to a disease called anthracnose (*Gloeosporium venetum* Speg.) which shortens the life of a plantation in the North. If hardier types of a black raspberry can be developed, it will be a great benefit to the commercial growers of this crop. Mr. George Darrow of the United States Department of Agriculture, is interested in developing a hybrid between the black raspberry and the Himalaya raspberry (*Rubus ellipticus* Smith). The latter makes a rank vegetative growth and could perhaps transmit some of this character to the black raspberry which makes a relatively weak plant growth. As pollen of the raspberry can be shipped readily when dry and keeps its vitality for some time, we shall attempt to supply Mr. Darrow with pollen of the Himalaya berry sufficient for his needs.

We have here in Porto Rico an Indian berry which has many of the characters of the northern black raspberry but which is apparently resistant to the anthracnose disease. The plants root at the tips of the canes, the spines are typical of the raspberry as also the fruit and the glaucous character of the stems. This species is now growing vigorously in Rio Piedras and at Aibonito and appears to be very promising. (This berry has lately been determined as a form of *Rubus niveus* probably *Rubus lasiocarpus*.)

It is interesting to note several species of Rubi which are cultivated in other parts of the tropical world and which are now growing in Porto Rico. The Andes berry (*Rubus glaucus* Benth) is a black raspberry from Central and South America and is cultivated to some extent in those regions. *Rubus niveus* Thunb. which occurs wild in the Himalaya mountains is under cultivation around Bangalore, India. It produces red, orange or blue-black fruit. The Akala berry of Hawaii (*Rubus macrei* Gray and *R. Hawaiiensis*) is an excellent raspberry and occurs in two varieties, one producing purple fruit, the other yellow. In parts of Florida and in Australia the Himalaya raspberry (*Rubus ellipticus*) is cultivated for the small yellow fruits abundantly produced on the plants. Two other forms which are cultivated in Australia are *Rubus moluccanus* Linn., a large raspberry-like plant (indigenous to India and Malaya) and *Rubus probus* Bailey, the Queensland raspberry developed near Brisbane, Australia. This berry is a cross between *Rubus ellipticus* and *R. rosaefolius* Smith and has been here in Porto Rico for some 12 years past but has been cultivated to only a slight extent. The plant grows vigorously under proper treatment in Porto Rico and although very productive gives fruit of rather ordinary quality.

A few other Indian species which we have received from the Royal Botanic Gardens, Ceylon are *Rubus fruticosus*, *R. glomeratus* and *R. var.* From the United States Bureau of Plant Industry at Washington we have received a shipment of the following species, *Rubus innominatus* S. Moore, *R. lasiostylus* Focke, *R. adenophorus* Rolfe, *R. coreanus* Miq. and *R. melonasius* Focke. These berries are natives of China, a region which is rich in plants of the family Rosaeceae. Many of these species are looked upon favourably by plant breeders in the United States where climatic conditions more nearly approximate those of China, but their value in the tropics is questionable though they are certainly worth a trial here for possible merit as hybridizers. *Rubus innominatus* was one of the parents of the excellent raspberry "Van Fleet" which has lately appeared so promising a variety for cultivation in the Southern States.

We have also two interesting berries which are closely related to our wild so-called "fresa." These are Thunberg's raspberry (*Rubus thunbergii*) from China and Burbank's Balloon berry which is an improved form of our naturalized *Rubus rosaefolius* (fresa). The fruit of the Balloon berry is much larger than our fresa and as the name indicates the berry is round-shaped like a balloon. The foliage of the balloon berry closely resembles that of our wild raspberry except that the leaves of the former are somewhat larger and the plants evidently not so spiny. Both Thunberg's raspberry and the Balloon berry assume the dwarf spreading habit of *R. rosaefolius* and sucker very freely at the roots. The species are interesting by way of comparison, even though they may not prove of much fruiting value under our conditions.

As the Akala berry of Hawaii is one of the most promising Rubus introductions ever brought to Porto Rico, a brief discussion of the plant is timely. This berry was first discovered by a United States Exploring Expedition on the slopes of Mauna Kea at an elevation of 6,000 feet. Hillebrand in his "Flora of Hawaii" says "the species can be recommended for cultivation." The Akala berry occurs on several islands of the group as for example, Kauai, Malakai, Maui and Hawaii. The berry generally makes a shrub several feet in height but sometimes assumes the proportions of a liana.

It is a most prolific bearer and the buds of the whip-like branches bend under the weight of the luscious heavy fruits. There are two distinct varieties—one dark purple and one a bright orange yellow. One of the yellow fruits exceeded in size even the largest of the purple fruited variety; it was in fact larger than a silver dollar being two inches in diameter. The yellow variety was, however, quite spiny while the purple one was almost spineless, only the young shoots being armed. The berries average probably about an inch and a half in diameter.

The juiciness of the fruits is remarkable—a fact which might prove a disadvantage as it will probably make the berry a poor shipper. The seeds are quite small and all the rest is juice. The dark variety is slightly bitter while the yellow variety is quite sweet and really delicious.

The testing of these berries is being done at Rio Piedras and in the hills on the farm of the New Hotel Co. at Aibonito. The large quantities of native "fresas" which are brought from the hills to San Juan indicate a sale for berry fruits in Porto Rico and is, we hope, merely the opening wedge for berries of better quality which are to appear later on. The preserving value of raspberries as jelly and jam must not be overlooked.

We are indebted to Mr. J. F. Rock of the U. S. Bureau of Plant Industry for information concerning the Akala raspberry.

Subscriptions to Lord Milner's Appeal for £100,000 as an endowment fund for the Imperial College of Tropical Agriculture should be addressed to the Secretary, Imperial College of Tropical Agriculture or to the bankers of the Fund, the Colonial Bank, 29, Gracechurch Street, E.C.

UBA CANE.

PROFESSOR J. SYDNEY DASH, B.S.A.

THE subject of this article has been very prominent in sugar literature during recent years. The cultivation and rapid spread of Uba cane in places where the thick canes have hitherto held sway are constantly before the minds of growers in most sugar producing countries. The increasing popularity of this variety is due, in the first place, to its hardiness generally in the matter of disease and adverse agricultural conditions, and in the second to ease and cheapness of production. Its value where mosaic disease has been allowed to get the upper hand can no longer be disputed.

In South Africa where Uba forms 99½ per cent of the cane crop, this variety would seem to be almost indispensable under the climatic conditions peculiar to that country. Yet, to judge from recent reports, entire dependence on it is no longer being thought of, having been found susceptible to a disease known as "streak," which attacks other varieties as well and which although not the same as mosaic appears to be in the same class. (They are regarded as two separate and distinct troubles; both have been found to co-exist in the one plant.) For this and other reasons, notably factory difficulties in its working, South Africa would welcome another variety. Uba will, however, continue to serve the country well for some time to come.

In the West Indies there are no signs that Uba's friends are wishing to abandon it. On the contrary, in many quarters it is frankly admitted to be a godsend, with which view one may, within limits, agree. It remains to be seen whether streak disease has followed Uba to these parts; in any case, some growers are so committed to it at the present time that it will be a difficult matter to get rid of this variety expeditiously, even if they so desired. The chances are, that from its very nature, Uba will continue to spread and strengthen itself until defeated by the very forces it is supposed to combat—disease and adverse conditions, and we might add, slovenly agriculture, for it is not unlikely to become the panacea for the ills attendant on the latter. The writer does not wish to give the impression of being hostile to Uba cane; its merits in special circumstances must be recognised—apart from forage crop value—but there is a danger of its being both abused and misused.

The engineering and manufacturing difficulties connected with this variety being well known, factories are not anxious to handle Uba if it is at all possible to avoid doing so. With continued extension of its cultivation, the question will arise—it may have already done so—as to what should constitute a fair and reasonable price to pay for it *vis-à-vis* the thicker and better (from the factory point of view) varieties. In this connection, much will depend on the individual factory equipment and the capacity to deal effectively with cane of this type. A practice in vogue at present in some places is to grind Uba mixed in the proportion of one-third with the better milling canes. Little difficulty in the West Indies appears to have resulted where this has been followed. The extent of the handicap caused by Uba would not seem an easy matter to determine with exact mathematical precision except in mills where it has been worked up exclusively in comparison with other varieties over a reasonable period of time. It should be possible, however, to arrive at a figure which is fair to all concerned, based on the experience in countries where Uba is extensively grown and from such data as may have already been collected by those likely to be interested in the future. Variations in results may be expected due to differences in equipment, locality, quality of cane, &c.

Dr. Maxwell in his report on sugar manufacture in South Africa (referred to in the *Louisiana Planter*, July 5th, 1924) states that Uba cane may be regarded as a handicap of from 15 to 20 per cent. With all the years of experience in dealing with it there the handicap is still a heavy one. Australian experience with Uba may also be cited. *The Australian Sugar Journal* of May 9th, 1924, gives the details of a controversy over the purchase price of this variety, in which the Fairymead Sugar Co., Ltd., claimed rebates of 5*s*. per ton cane. Mr. C. E. Young of the company is quoted as saying: "Our company do object to this cane at full schedule of prices maintaining it should be a disapproved variety, or subject to a reduction of 5*s*. per ton cane. Our reasons for so objecting are not only the difficulties of crushing or the high fibre—except as the latter quality means a smaller return of sugar for the day's work—our main objection is the refractory nature of the juice, and the large amount of wax contained in Uba, making clarification very difficult, and so far no success has been attained in improving this, though capital has been spent each year Uba has been treated. The vacuum pan and centrifugal work also crystalisers in motion have been hampered and slowed down, sometimes by increased viscosity, sometimes by unavoidable false grain; and finally the same recovery cannot be attained when working Uba, and its viscosity prolongs the time required for manufacture. We may point out that even when sucrose is good generally purity is lower, and wax is always present reducing the value of the cane for milling and this is never shown in commercial cane sugar determinations, nor is the gum, also present. For these reasons we claim a rebate in price of 5*s*." Calculating this on the 1923 Trinidad cane prices (period nearest to the time of this discussion) it amounts approximately to a cut of 25 per cent.

The above information is put forward merely as a rough guide to those who may be contemplating transactions in Uba and canes of that class.

MYCOLOGICAL NOTES.

The Withertip and Blossom-blight of Limes.

THE serious disease of the commercial variety of lime grown in the West Indies caused by the fungus *Gloeosporium limetticolum* (*Clausen*) is known to be present in Trinidad, Tobago, British Guiana, Dominica and St. Kitts. It was attacking the same variety in Florida for a number of years before it was recorded from the British West Indian Region.

Infection can take place only on the very young shoots, on all parts of the flowers, and on young fruit less than a half inch in diameter; as the tissues harden they become resistant to infection. The attack on the flowers and setting fruit may be responsible for serious reduction of crop. Attempts are now being made especially in Trinidad, Dominica and Florida to raise other presumably resistant varieties of limes with a view to replacing the susceptible kind in commercial plantings, and this is the more necessary because effective control of the disease by direct methods such as spraying and dusting has not been found economically feasible. Recently H. R. Fulton has carried out a comprehensive series of inoculations with the fungus on a large number of citrus varieties and species in Florida and Washington and recorded the results in the *Journal of Agricultural Research*. He points out, in the first place, that under field conditions in Florida the only kinds of citrus found affected by the disease are the ordinary lime known as the West Indian, Mexican, Common Florida or Key lime and the Dominica spineless lime (apparently a sport of the common lime which was discovered on an estate in that island in 1892). The Kusaie, Woglum's Seedless, Buena Vista, Tahiti and Persian varieties were not affected even when growing near diseased common limes. In 1919, 1920 and 1922 attempts were made in Florida orchards to infect a large number of different kinds of citrus with spores of the fungus taken directly from diseased common limes in the vicinity or with spores from pure cultures of the fungus. The inoculations were made on young tender shoots either with or without puncturing. The results were recorded as positive, doubtful or negative. The common lime and the Dominica spineless lime gave strongly positive results 89 and 86 per cent. respectively of the inoculated shoots developing the disease even when not punctured. The results with Tahiti, Rangpur and the common lime hybrids limequat and faustrime were entirely negative, and equally negative were the results with citrons, lemons, oranges, grapefruits, mandarins and other species of citrus and related genera.

Greenhouse Inoculation.

A first experiment was carried out with 3 potted plants of each variety which were cut back to induce sprouting of young shoots. When the sprouts started the plants were put into an inoculation case in which the air was kept saturated. Spores of the fungus were atomised on to the young growth 10 times in 21 days. At the end of this period the shoots were rather eliolated (deficient illumination?) but still succulent. They were then dipped in a strong suspension of spores, wrapped in wet cotton wool and replaced in the inoculation cases for a further 4 days and final observations were made 8 days after removal from the cases.

In this severe test all the shoots of the common lime were destroyed by the disease but the Kusaie and Sweet lime and varieties of lemon, orange, grapefruit and mandarins remained quite unaffected.

In another experiment three potted plants carrying young growth were kept for six days in saturated air in cases and were punctured and swabbed with spore suspensions and again twice atomised with spores during that period. The common lime plants became fully infected but the results were wholly negative with Sweet lime, Rangpur, and varieties of lemon, orange and grapefruit.

Another experiment was made with older plants (1-3 years) in the greenhouse. These were well branched and furnished with good flushes of young growth. Inoculation was made mostly with spore suspensions from active lesions on common lime but also with spores from pure cultures of the fungus applied on wet cotton wool the shoots being then wrapped in paraffin paper; in some cases the young limes were abundantly punctured. The plants were kept in large glass chambers over wet sand and examined after 7 and 10 days. The results were recorded as positive, doubtful and negative. In the unpunctured series the common lime and the Dominica spineless lime showed respectively 57 and 100 per cent. of the shoots infected but the results with Kusaie, Sour lime (No. 7338) and Sweet lime were wholly negative; Persian and Rangpur were negative except for 5 and 2 per cent. doubtful infections: the common lime hybrids limequat and faustrime were wholly negative. No other kinds of citrus gave definitely positive results but some citrons and lemons showed 11-20 per cent. doubtful lesions. In the punctured series only the common lime and the Dominica spineless, gave definitely positive results —93 and 100 per cent.; Persian, Rangpur and Sweet-lime showed some doubtful infections but Kusaie and No. 7338 were entirely negative. No other kind of citrus proved definitely positive but some citrons, lemons, grapefruits, hybrids and oranges yielded some doubtful lesions. None of these doubtful lesions, however, developed spores of the withertip fungus. It is probable that the doubtful cases in the last experiment may have been due to the paraffin paper wrapping round the shoots (kept on for 10 days) interfering with gas exchange and affecting the vitality and natural resistance of the tissues to weak parasites.

In the first three inoculation experiments one in the field and two in inoculation chambers where the shoots were not wrapped in an impervious material only the common lime and the Dominica spineless lime proved susceptible to the wither tip fungus.

The other varieties of lime tested, Tahiti, Kusaie, Persian, Sour lime 7338, Sweet lime, Rangpur (probably not a true lime) and the common lime hybrids, limequat and faustrime showed complete resistance. On the basis of field observation Woglum's Seedless and Buena Vista are also, at least, highly resistant varieties of lime. The Kusaie (or Kusai) lime which in these tests and also in tests made in Trinidad appears to be immune to withertip was introduced from Hawaii where it is regarded as one of the best kinds of lime; it is being raised from seed in Trinidad and Dominica and may prove a valuable substitute for the susceptible common lime. It is noteworthy that limequat and faustrime—hybrids between the common West Indian lime and species of citrus resistant to withertip—have proved practically immune to the disease.

S. F. A.

REFERENCE.

Fulton, H. R., Relative susceptibility of citrus varieties to attack by *Glocosporium limetticolum* (*Clausen*).—*Journal Agricultural Research*, July 30th, 1925.

THE JACKPAN.

WE have received from the Plantation Engineering and General Supplies, Ltd., of 3, Grosvenor Gardens, London, S.W.I., particulars of a new pan-breaking tool termed the "Jackpan." The construction of the tool, which is designed to be used by hand, resembles that of a pick, save that the point is replaced by a chisel edge 2 inches wide. This expands, at the handle, into a broad flat, pear-shaped disc, about 4 inches in radius, perpendicular to the handle. The length of the pick-like blade varies in length from 13 inches to 18 inches according to the type of soil to be tackled. The jackpan is driven into the ground in the same way as a hoe but then instead of pulling the tool back as in hoeing, the handle is levered forwards and upwards, the pear-shaped disc acting as a fulcrum, its broad bearing surface preventing it from cutting through the soil. As the handle is levered forward the blade and point of the tool move upwards and backwards on the radius and arc of a circle respectively, breaking up and loosening the soil to some distance on each side of the blade, and breaking through any pan which may be there. It is not claimed that the jackpan is a substitute for the hoe but that it tackles some of the operations which have wrongly been assigned to the hoe in the past. In breaking up subsoil pans and deep cultivating heavy sunbaked soils it performs the work much more efficiently and easily than the hoe. It has been tried out by Agricultural Departments and planters of several tropical countries and has proved remarkably successful in the work for which it was designed.

MOSQUITOES.

The Hayling Island Institute.

BY SIR ARTHUR E. SHIPLEY, G.B.E., F.R.S., *Chairman of the Governing Body of the College.*

IT used to be a convenient distinction to regard all those insects which belong to the family *Culicidae* as gnats, and those belonging to the family *Anophelidae* as mosquitoes; but this distinction has recently been ignored. It seems a pity, because all those mosquitoes which convey malaria from man to man belong to the latter group, and, further, the two groups can be fairly easily differentiated.

Altogether there are some fourteen hundred distinct species belonging to these two families; only twenty-five occur, as far as is at present known, in Great Britain. Three of these belong to the *Anopheles* group, which is, of course, the most dangerous, and amongst the three is *Anopheles maculipennis*, which is the common carrier of malaria in Europe. Malaria, owing to drainage and the use of quinine, had until more recently practically disappeared from Great Britain; in fact, for some twelve years at the beginning of this century only one case was recorded in which malaria occurred in a patient who had never left the island. On the return of the soldiers, many of whom suffered from malaria, it was thought that with the insect-carrier so abundant and so widely distributed the malaria might regain its hold on Great Britain. This has, however, fortunately not proved to be true. Cases have occurred, but nothing like an epidemic has been noticed. Apart from malaria, bites of gnats or mosquitoes are sometimes accompanied by severe disorders, and at times terminate in death. This is due to some septic organism which has been mechanically introduced by the piercing weapons of the insect into the blood of the bitten.

Speaking generally, mosquitoes are either domestic or rural. The first class breeds in the neighbourhood of houses, in water tubs, water standing in conservatories, water that has accumulated in broken jampots or in sardine tins which have been thrown on the refuse heap. These mosquitoes are those most met with in urban districts. The second class breeds in any stagnant fresh water, in ditches, swamps, pools, or lakes. Thirdly, there is a class which is the pest of our sea coasts, and these mosquitoes will breed in salt or brakish water.

In Hayling Island the four most abundant mosquitoes are:—

(1) OCHLEROTATUS DETRITUS (I apologize for the name, but I did not invent it and can take no responsibility for it).—The only British mosquito which breeds exclusively close to the sea. It has a long hatching-out season—that is to say, it will produce young from March until October, and the young very quickly turn into adults. It further has great powers of flight, so that it is beyond all doubt the greatest nuisance to the seaside tripper.

(2) OCHLEROTATUS RUSTICUS.—This produces only one brood in May. It is a particularly large creature and it passes the winter either as an egg or as a larva. It occurs in the stagnant water of neglected ditches.

(3) THEOBALDIA ANNULATA.—The largest of all and a really handsome insect, but its habits are deplorable, and its larvae are often found in the filthiest water.

(4) CULEX PIPIENS.—This is the common gnat, whose evening dances surpass in agility and grace those of the Russian ballet. It is a very common form which breeds in water butts and tanks in the proximity of man. It is doubtful whether its bite is as severe as that of the other three mentioned above.

The weak point of a mosquito's life is its larvae and its pupae. They live in the water, but they breathe air; hence they have to pierce the surface film in order to obtain the oxygen from the only medium they can use.

If anything intervenes between the open-end of the breathing tube and the air, the larvae or the pupae of the mosquito perish and the insect does not hatch out. This intervention can be effected by oiling the water—that is to say, a brush or bunch of twigs is dipped in a vessel containing oil and is then swished about in the water. The floating oil forms a thin but absolutely impenetrable layer, and the larvae and the pupae are killed.

By the recent researches of Dr. Keilin, of the Molteno Institute, a new light is thrown upon what happens to these organisms when the water is oiled. I had always assumed, in common, I think, with most zoologists, that mosquito larvae and pupae were destroyed by the petrol or paraffin layer preventing the access of oxygen to their breathing tubes. But the process of suffocation is by no means so simple as that. Dr. Keilin has discovered—and it is with his permission that I announce it—that certain cells of the breathing tubes produce a fatty substance which effectually prevents the intrusion of water into the spiracles and the tracheae of the larvae and the pupae. He has shown that paraffin and such other substances as chloroform, and even strong alcohol, destroy these fatty substances, and as soon as they are destroyed water can enter, and *does* enter, the spiracles and the tracheae, and in effect the larvae and pupae are suffocated by the presence of water and not by the absence of oxygen. Their breathing organs become full of water as a man's lungs fill when he is drowned. If, as I have every reason to believe, Dr. Keilin's observations are correct, the penetration of gases through the oil film can be left out of account.

Another action of the oil is to check evaporation and to limit the passage of gases from the air to the water or from the water to the air to diffusion alone. This is an extremely slow process, and Mr. J. T. Saunders tells me that it has been calculated that if Lake Constance were to be deprived of all its dissolved oxygen and there was no movement of the waters, so that the replacement of the gas must be by diffusion alone, it would take one million years before the replacement was complete.

Mr. J. F. Marshall, whose devoted work will be recognized to-day by the opening of the Hayling Mosquito Control Laboratory, sums up the various methods of destroying mosquitoes as (i) eliminating the breeding places and (ii) killing the larvae. There is no doubt that of the two processes, that of abolishing the breeding places is the more satisfactory, but it requires constant care. Every filled-in place requires annual inspection, or it may easily refill unless the drainage is properly cared for. Browning says :—

> Where the water is stopped in the stagnant ponds
> Danced over by the midge.

The aim of the mosquito controller is to prevent that water being stopped. There is a certain disadvantage in paraffining the water, because, as I have said, it checks evaporation, and may, if done on a large scale, interfere with the rainfall. Further, it kills all other floating organisms. The experiment of stocking the water with enemies of the larvae is not very promising. Mr. M. Macgregor has pointed out that, whereas the streams in Mauritius are full of "millions" of little fish which eat the mosquito larvae, malaria is very prevalent in that colony, whereas in the neighbouring island of Rodriguez there are no "millions" and no malaria. In the many months Mr. Macgregor spent in the Mauritius he found that neighbouring waters harboured different kinds of mosquitoes. For instance, one pool would be full of *A. costalis* and *A. funestis*, both of them carriers of disease, whilst similar waters not far off contain only the innocuous *A. mauritianus*. Probably, as he states, this is dependent on some slight variation in the acidity or alkalinity of the waters. But he makes one practical suggestion, and that is that only those pools should be filled in which contain the nocuous forms. This is of course an economic question. The Government would have to employ entomologists capable of distinguishing the nocuous from the innocuous species, and it might possibly be found cheaper in the long run to fill-in all the breeding places and thus put out of action the unharmful as well as the harmful.

The success of Mr. Marshall's efforts during the last three years is shown in his last report, in which he sums up the answers to certain questions which were addressed to 168 old inhabitants of Hayling Island; 74 per cent. of them sent in answers, and of these 115 maintained that the number of gnats had "much decreased," whereas 10 were content with saying that they had "decreased."

At the end of his report on his work in the Mauritius Mr. M. Macgregor says that but for malaria "Mauritius might rank as a most coveted spot in which to live." But he conceives that if properly attacked malaria might disappear. He says the question is not "Is it possible?" but "Will it be done?" As for Hayling Island, we think that owing to Mr. Marshall the response to the last question will be "in the affirmative."
— *The Times.*

TROPICAL WORLD NOTES.

Brunei.

It is satisfactory to note that the prosperity of the State of Brunei noted during 1923 (See *Tropical Agriculture* Vol. II, No. 5, p. 105) has been well maintained during 1924, the total revenue, amounting to $257,474, exceeding by $35,807 the previous record established in 1923. The estimated revenue and expenditure promised a deficit of $32,330, but became, in reality, a surplus of $9,895. Among exports the most noticeable features were the decreased output of Cutch and the continued decline in the Sago trade. Plantation rubber, the principal export increased in quantity from 835,633 lb. to 1,065,489 lb. and in value from $363,200 to $387,793. There are five European-owned rubber estates, four of which have reached the bearing stage. The production of rubber is about equally balanced between European and native-owned properties but most of the trees in native holdings are badly wounded through inferior tapping. Disease, unfortunately, is fairly prevalent and one European estate suffered considerably from the depredations of porcupine in addition to the ever-present pig, white ants and deer. Unfavourable weather resulted in a 20 per cent. drop in the rice crop, in spite of the increased area cultivated. Imports show an increase in quantity under every heading, a sign of increasing population and prosperity.

Federated Malay States.

The Stevenson Restriction Scheme has given numerous opportunities of considering the economic value of pre-restriction modes of tapping, as compared with other methods which have been forced upon the planters since November, 1922. Experience shows that where daily tapping is continued over a period longer than three months there is normally an increase in the prevalence of diseases affecting the tapping cut. Conservative systems of tapping, besides preservation of bark, mean lower disease incidence and prolongation of yielding capacity. During the restriction period the incidence of "brown blast" has been so low that enquiries with regard to it have practically ceased. Some of the older rubber holdings in Malaya contain ten to fifteen per cent. of trees affected with root disease (usually Wet Rot caused by *Fomes pseudo-ferreus* or Dry Rot caused by *Ustulina zonata*). Special individual attention is being given to these areas. According to the annual report of the Department of Agriculture the exports of copra increased from 49,037 tons valued at £8,190,701 in 1923 to 55,197 tons valued at £9,641,012 in 1924. The total area under coconut cultivation is estimated at 163,402 acres of which 61,996 acres are in estates of more than 100 acres. Considerable interest has been shown in the oil-palm as a large-scale plantation crop and nearly 6,000 acres have already been planted. Malayan palm-oil has already established a high reputation and it is expected that the acreage devoted to this crop will increase.

Mozambique.

Since the Anglo-Portuguese Treaty of 1891 laid down the boundaries between the British and Portuguese spheres of influence in Southern Africa, Great Britain's direct political interest in Mozambique has been confined to military operations during the Boer War and the East African campaign during the Great War. The Union of South Africa, the colony of Southern Rhodesia, the protectorate of Northern Rhodesia and Nyasaland and the mandated territory of Tanganyika surround Mozambique on the landward side. Tanganyika and Mozambique have, as yet, had little intercourse but three of the British territories are and must remain dependent on the Portuguese port of Beira as their principal outlet to the sea while the greater part of the wealthiest province of the fourth finds in Lourenço Marques its nearest port.

The settled portion of Nyasaland is surrounded on the three sides by Portuguese territory. With the discovery of the Chinde mouth, Nyasaland was granted, on a 99 years' lease, a concession through which imports and exports were passed, a Nyasaland Customs officer being stationed at the port of Chinde. With the completion of the Trans-Zambezia railway three years ago, the Chinde concession was surrendered and Beira became the sole outlet for Southern Nyasaland. Pending the construction of a railway from the North end of Lake Nyasa to connect with the Tanganyika Central Line and provide a new route to the sea at Dar es Salaam, the entire protectorate must find its outlet at Beira The bridging of the Zambezi to connect the South and North bank railheads at Murraca and Chindio, the provision of deep water wharves at the port and a single customs examination on traversing the Mozambique Company's and the State administered territories will add considerably to the export facilities. It is interesting to note that the British Protectorate has guaranteed the interest and sinking fund in connection with the debentures of the Trans-Zambezi Railway Company which operates entirely in Portuguese Territory. Similar arrangements may be made for the construction of the Zambezi Bridge.

Northern Rhodesia, a youthful British Protectorate of little more than a year old, finds its access to the sea either through Southern Rhodesia or Nyasaland, and Beira. If and when the Zambezi is regulated to provide a continuous waterway from Northern Rhodesia to the sea that river may become of enormous importance to the British Protectorate.

The inadequate port facilities at Beira have occasioned considerable anxiety in Southern Rhodesia for since the termination of the war the increasing mineral production, the development of agriculture in Southern and Northern Rhodesia, and the transfer of the Nyasaland and Middle Zambezi traffic from Chinde to Beira, have necessitated provision being made for the complete transformation of Beira into a modern port equipped with deep water wharves

and other facilities to enable ships to be discharged and loaded with the minimum delay. The Port of Beira Development Company, Ltd., was founded in 1923, and with the full co-operation of British and Portuguese interests there is every prospect of the port being placed in a position to cater adequately for the needs of its immense hinterland without involving any additional transport charges.

Zanzibar.

The clove crop for 1924 proved very satisfactory, the production being estimated at over 700,000 fraslas, compared with 311,794 fraslas during the previous year, and an average of 512,597 fraslas during the past 20 years. Prices were good, particularly during the first half of the year when Rs. 25-26 ruled for Zanzibar cloves. The average for the whole year was Rs. 23 per frasla. During the year the question of working expenses on clove and coconut plantations was considered and in the island of Zanzibar the plantation owners came to an agreement about rates of pay for piecework weeding. Although the new rates have resulted in a considerable reduction in working expenses, labourers can still earn twice the pay received on the mainland for approximately half the work. Since the islands are dependent on the free immigration of labour from the mainland, it is inevitable that rates of pay must be higher. In Pemba rates of pay for weeding and harvesting are even higher and coupled with the heavy transport charges it is difficult to see how plantations can be run at a profit, particularly in view of the fact that Pemba cloves realise a lower price than Zanzibar in the market. The condition of many of the plantations in Pemba reflects this unprofitableness. The average age of the clove trees, particularly in Pemba, is much higher than it should be and it will be impossible to maintain the present output without systematic replanting. Since all the suitable land is already under cloves, regeneration is the only method of keeping up the supply and to assist this the Government is offering a bonus of Rs. 3 per tree, spread over 6 years, to owners who raise young trees under approved conditions, each tree being inspected and sealed on three occasions during the period. Bonuses were paid on 23,247 one-year-old trees in 1924. The export of copra during the year reached the record figure of 988,393 fraslas, the average for the previous 10 years being 534,191 fraslas. The quality is poor, sun-drying being often impossible while the fire-drying practised is of the crudest description. A copra factory has been established by the Government at Mtoni for demonstration purposes. The prices realised by this factory were several armas per frasla above local prices, and it is thought that a greater premium would be obtained overseas. The Department of Agriculture is engaged in collecting statistics relative to the number of clove trees and coconut palms on the plantations of the two islands.

Jamaica.

The year 1924 was an unfortunate one for Jamaica's principal industry, banana growing, since, although the exports declined from 12,454,216 stems in 1923 to 11,971,087 stems in 1924, values declined from £2,265,116 to £1,225,345, a decrease of more than £1,000,000. The state of the industry has been the subject of discussion in both Houses of Parliament and it is hoped that by providing adequate shipping facilities to England a larger market may be opened up for the Jamaican grower with the prospects of more remunerative prices. *Inter alia*, it may be noted that Dr. Harland, Professor of Botany at this College, is now on a visit to the East for the purpose of discovering a type of banana which, while satisfying marketing conditions, will be immune to Panama disease (Wilt). Experimental plots have been established at the College and other bodies are conducting investigations towards the same end. Sugar also declined in quantity from 515,368 cwt. to 458,394 cwt. and in value from £674,769 to £497,723. Exports of rum, however, showed a considerable increase rising from 537,524 gallons valued at £51,765 in 1923 to 730,456 gallons valued at £121,651 in 1924. Coffee fell in quantity by nearly 25,000 cwt., the 51,921 cwt. exported being valued at £225,449. Exports of coconuts rose in value from £128,483 to £132,073 but copra fell in quantity from 5,207,094 lb. to 3,743,426 lb. and in value from £49,919 to £43,583. Cocoa and logwood both increased in quantity and value. Pimento, and lime-juice although decreasing in quantity increased in value.

Ashanti.

Ashanti is constitutionally separate and distinct from the Gold Coast Colony and the Northern territories but since all three are treated as one financial unit it is impossible to estimtae with any accuracy the revenue and expenditure of the separate areas except for those items which are purely local. The Commissioner of the Eastern Province reports (*See* Annual Colonial Report for 1924, No. 1252) that the trade of his area showed an improvement upon last year, but since purchases are to a great extent regulated by the price of cacao, which was down nearly to pre-war levels, the natives were unable to buy commodities which have risen considerably in price. The Commissioner of the Western Province similarly reports on decided improvement in trade, particularly in the vicinity of the motor roads. He reports, for example, that the people of Chirrah on the Sunyain-Wenchi Road were unable to sell their cacao during the previous year but owing to the opening of the road they were able to dispose of all their available cacao at prices ranging from 3*s*. to 5*s*. per load. The opening of the road should result in a considerable improvement in trade since it taps the most productive area in the Province. The Government is not, however, confining its activities to the cacao industry and considerable attention was paid to subsidiary industries such as oil-palms, coffee, kola, and various food crops.

THE ISOELECTRIC THEORY.

Its Application of Certain Problems of Crop Products Manufacture, and Soil Fertility.

BY PROF. F. HARDY, M.A.

[*This article forms the Fourth Part of a Series of articles that attempt to apply a modern theory of colloidal behaviour to some tropical agricultural problems. Part I (August issue) stated and explained the Isoelectric Theory, and in it especial consideration was given to the general problem of precipitation of hydrophilic colloids by certain added electrolytes. Part II (September issue) described the physical-chemistry of coagulation in rubber latex, based on the isoelectric theory, and Part III (October issue) dealt similarly with defecation in sugar-cane juice.*]

PART IV.

II.—APPLICATION OF THE ISOELECTRIC THEORY.—*Continued.*

(*a*) Manufacture of certain Crop Products.—*Continued.*

3.—*The Fermentation of Cacao.*

THE fermentation of cacao, as usually practised on the plantation, has been described by S. F. Ashby, in the May number of this Journal, 1925, p. 99. The details need not be restated; attention will be confined here solely to an examination of certain physico-chemical phases of the subject that appear not to have received the consideration they perhaps deserve.

A conspicuous result of the micro-organic fermentation of ripe cacao beans is a rising temperature, which "kills" the beans at about 110°F. (43°C). Consequently, certain enzymotic substances contained in the cells of the embryo gain access to compounds on which they can act, and new substances are produced, certain of which may eventually confer desirable flavour, aroma and colour on the finished product. Thus, fermentation is believed by some to be an essential process in the manufacture of high-grade cocoa.

The term "killed" as applied by the biochemist to plant cells, is usually interpreted as meaning that the physico-chemical properties of their colloidal components (notably those components that form protoplasm), have been so profoundly altered by some treatment that unhindered diffusion takes place between the various substances dispersed in the cell sap. The semi-permeability of the membranes enclosing the cells is destroyed, and the sensitivity of the whole system to changing environmental conditions is lost. Heat treatment is not the only agency that can effect this profound result. Many chemical substances, including so-called poisons, also cause death. Particularly interesting amongst these are acids and alkalies which, when in sufficient concentration, alter the permeability of plant cell membranes to a degree that can be approximately measured by determining the intake and outgo of dissolved matter.

Recent work has suggested that the effects of acids and of alkalies on cell permeability, may perhaps be due to the modifying influence of hydrogen-ion and hydroxyl-ion on the physico-chemical properties of the proteinous components of the plasma membranes. The seproteins are assumed to possess isoelectric points, near which the permeability of the protein aggregates is least, probably because volume shrinkage here is greatest. Pearsall and Ewing (1) have adduced experimental evidence in support of this view, and have deduced a method for determining the approximate isoelectric points of certain proteins based on the isoelectric theory of colloidal behaviour.

Pearsall and Ewing's Experiment.

Pearsall and Ewing's method is especially applicable to plant tissues whose cell-sap contains abundant colouring matter. It was strikingly demonstrated by the behaviour of red beetroot, exposed to aqueous media of different hydrogen-ion concentrations. Pieces of red beet, of uniform size and colour, were placed in solutions containing different amounts of acid or of alkali, and the diffusion of colouring matter into the liquid was noted at intervals of time up to twenty-four hours. The initial pH value, and the pH value at the end of this period, were experimentally determined for the different solutions. It was found that copious diffusion of colouring matter into the liquid occurred only at pH values less than about pH 4·4, and this was therefore assumed to be the isoelectric point of beet protein.

The Isoelectric Point of Cacao-bean Protein.

The writer has repeated Pearsall and Ewing's experiment with purple Forastero cacao beans, using ripe whole beans, whose slimy testas had previously been removed, leaving the naked embryos. It was found that rapid diffusion of colouring matter occurred at approximately pH 3·8 and under. This figure (pH 3·8) nearly coincides with the pH value of the aqueous liquid (cacao sweat) produced during a twenty-four hours fermentation, and suggests that the killing of cacao beans by fermentation, may be caused, not necessarily by rise in temperature, but by acid.

In order for killing to occur, the acid sweat must gain access to the embryo-tissues either by penetrating the leathery seed-coats, or by passing through the micropyles. That the seed-coats of cacao are appreciably porous, or are rendered porous by the effect of acid, is indicated by the rapid drying which occurs when beans are exposed to sun and air. Porosity may also be proved by periodic chemical analyses which reveal the transference during fermentation of certain substances, notably theobromine, from the tissues of the embryo into those of its envelope.

The pulp which covers fresh ripe cacao beans, contains citric acid (2), but the acid is unable ordinarily to escape from the pulp-cells until their walls have been broken down, and their contents liquefied, through the activity of certain micro organisms. Furthermore, when this has occurred,

alcoholic and acetic organisms convert the liberated sugary components of the pulp-cells into acetic acid, which augments the natural acidity of the runnings. We therefore have the requisite conditions in a cacao sweat-box for the killing of cacao beans by acid, and, provided sufficient time is allowed for complete diffusion, acid activity may indeed be the primary cause of the increased permeability of the plasma membranes lining the embryo cells, and not temperature-rise. It is significant to note that the runnings from cacao sweat-boxes contain appreciable amounts of purple or red colouring matter, especially the later runnings. This proves that outward diffusion from the embryo cells actually does occur in ordinary practice.

The above considerations show that there are normally two distinct factors operative during the sweating of cacao, namely, heat and acidity; either of these may render the embryo cells completely permeable. It is interesting to speculate on the possibility of controlling these factors so that only one of them may be operative at any one time.

The Heating Process.

A process which entirely eliminates the acidity factor was proposed some twenty years ago by Fickendey in German Kamerun (3). This process consists in heating the pulp-freed cacao beans for 24 hours at a temperature between 50°C (122°F) and 60°C (140°F) which kills the embryo and renders their cell membranes permeable, but is not sufficiently high to inhibit the activity of the enzymes.* The method was tried in 1910 in the British Gold Coast Colony, with highly satisfactory results. Whether or no its use was continued, is unknown to the writer. At least the process would seem to afford a better means of controlling the apparently necessary chemical changes that take place in material intended for the production of high-grade cocoa; it would doubtless eliminate some of the undesirable results (such as excessive acidity), which are often unavoidably obtained in the usual sweat-box fermentation process. No mention is made in the literature of the effect of the heat treatment on the pulp, and on the subsequent drying-rate of cacao beans. Since one of the most advantageous results of ordinary fermentation is a loosening and detachment of the pulp-cells of the cacao seed-coat (which makes it possible to dry the beans rapidly, and discourages moulds), it would be interesting to know how far this object is attained in the heating process.

The Acid Process.

As far as the writer is aware, no large-scale experiments have been conducted to test the efficacy of the suggested method alternative to the heating process. Loew (4) performed an interesting experiment in which he immersed whole ripe cacao beans in acetic acid solutions of 1 to 4 per cent. concentration (pH probably between 2·6 and 2·4), at 42°C (108°F), for 20 to 30 hours. He found that the treatment did not inhibit the action of oxiditive enzymes. Obviously, however, the embryos must have been killed, because of the high temperature employed. Loew further found that the pulp-cells shrank and became partly disintegrated, but they did not become completely detached from the seeds. He suggests that the agency of a bacterial enzyme is necessary to effect easy pulp separation, probably through some digestive action. A further experiment by Loew (5) showed that 4 per cent. acetic acid (pH 2·4), applied directly to the cut surface of a ripe embryo, destroyed the oxidative enzyme responsible for browning. Evidently, then, acid solutions of pH 2·4 and below are too strong for the purpose we have in view. In the writer's experiments (referred to in a previous section), cacao embryos treated with acetic acid solutions of pH value 3·8 to about 3·0 (say 0·005 to 0·5 per cent. by weight), showed free diffusion of colouring matter (cells "killed"), and yet turned brown on subsequent exposure to air. This experiment ought to be repeated on a large scale with whole ripe cacao beans in order to examine the effect of the acid treatment on pulp separation, and on final flavour and aroma in the roasted product.

Schulte-im-Hofe (6) reports that ripe cacao embryos, placed in "a diluted acetic acid solution" (pH not stated), changed colour, and suggests that "the changes brought about in the bean by alcoholic fermentation may, therefore, also be produced by the addition of acid." The writer's experiments confirm this observation. The conclusion that acid treatment may yield a final product differing but little from that produced as a result of fermentation, is not upheld, however, by Knapp (7), who states that a sample of shelled beans placed in acetic acid at 43°C, and subsequently roasted, did not give the same desirable aroma as that possessed by fermented and roasted beans. It is possible, however, that the *citric acid* component of cacao sweatings, plays a specific part in the development of aroma. Hence experiments an the process should be conducted, not only with dilute acetic acid solutions but also with dilute solutions of citric acid as well.

4. *Diffusion Processes.*

Pearsall and Ewing's experiments suggest an improvement in diffusion methods of extracting certain plant products that are dissolved in cell sap, for example, sucrose in sugar-beet and sugar-cane. Usually the raw material is sliced and immersed in neutral water. Acidification of the water to a suitable pH value, sufficient appreciably to increase cell-permeability, but not to cause significant loss of sucrose by inversion, might hasten the process and lead to greater recovery.

(*For references see next page.*)

* An essentially similar process has recently been devised by Dr. F. L. Stevens of the University of Illinois, who recommends a water-bath at temperature between 40° and 60° for heating the beans. Dr. Stevens' account was read at a meeting of the Trinidad Agricultural Society on April 8th, 1925; it will be summarized in a subsequent issue of this Journal.

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(3) *Bull. Imper. Inst.* 1912, X, 2, p. 243.
(4) "*Fermentation of Cacao*" edited by H. Hamel Smith, 1913, p. 53.
(5) *Ibid.*, p. 53.
(6) *Ibid.*, p. 82.
(7) Knapp, *Journ. Soc. Chem. Indus.*, 1924, 43, 17, p. 434.

(*To be Continued.*)

CHEMICAL NOTES.

Compiled by the Department of Chemistry and Soil Science.

Latest Report of the U. S. Fixed-Nitrogen Laboratory.

DURING the past year (1924), attention has mainly been given to (1) the technical application of certain new catalysts employed in the synthetic ammonia (Haber) process; (2) the production and high purification of hydrogen for use in this and in other processes, (3) the further development of the aluminium nitride method of fixing nitrogen, and of producing pure alumina and ammonia from the nitride.

In connection with the first of these projects, it is reported that the cost of production of synthetic ammonia has been reduced 50 per cent. by the use of the new catalysts, and that nearly 80 per cent. conversion of a mixture of nitrogen and hydrogen into ammonia has been obtained by employing pressures approaching 1,500 atmospheres. In connection with the second project, attention has been given chiefly to the manufacture of water-gas hydrogen, employing new catalysts for converting carbon monoxide and steam into hydrogen and carbon dioxide. Several methods for absorbing carbon dioxide from the product have been investigated, one of which has given very encouraging results.

Manganese and Sugar-Cane Soils.

THE interesting suggestion is made by A. C. Pestana (Director of the General Experiment Station at Campos, Brazil) that the high productivity of Hawaiian soils for sugar cane is not so much due to the variety of cane largely favoured, as to the peculiar characteristics of the soil, which contains abnormally large amounts of manganese and titanium. His experiments, devised to test this idea, are stated to prove that the addition of a small quantity of manganese sulphate to a cane soil resulted in marked increases in total yield of sucrose and in purity of juice (13·73 per cent. sucrose and 90·90 purity, against 11·34 per cent. sucrose, and 78·42 purity). Although, according to the published account, these figures are possibly not statistically significant (single plots were used), the idea is well worth putting to test on a larger and better-planned scale, for it is well known that manganese possesses especial properties in increasing the oxidative power of soil, and titanium, in improving its physical texture. These effects, however, are probably not exerted to the same extent under all soil conditions, since soils vary largely in degree of drainage and in chemical character.—"*Facts about Sugar*, March 28th, 1925, p. 298."

The Advantages of Fine Straining of Sugar-cane Juice.

IT is generally conceded by sugar technologists that the presence of fine particles of fibre (bagacillo, cush-cush) in cane juice is very undesirable, because the cellulosic material of which bagacillo is composed is liable to considerable chemical break-down during the processes of clarification. Thus pentosans and pectins are thereby gradually liberated, and in addition, an alkali-soluble colouring matter, usually known as saccharetin. The longer the bagacillo is exposed to the hydrolysing action of cane juice, both at acidic and at alkaline reactions, the greater are the quantities of these undesirable substances liberated into the liquors. Hence careful attention should be given to thorough straining of raw cane juice as it leaves the mill, especially when intense mechanical disintegration is practised by the employment of modern shredders. At the Third Annual Meeting of the Association of Hawaiian Sugar Technologists held at Honolulu in October, 1924, the subject of fine straining of raw sugar-cane juice was fully discussed (*See Facts About Sugar*, May 16th. 1925, p. 470). The results obtained at the H.S.P.A. Experiment Station, where the question was experimentally examined, indicate conclusively that fine straining, such as can be effected by the Peck strainer, increased the purity of the clarified juice by some 0·2 per cent., reduced the volume of settlings, yielded additional fuel, and lessened the danger of scaly accumulations at heating surfaces.

Offset against these benefits, is the greater difficulty of filtration at the filter press, for bagacillo forms an excellent filtration medium. It is difficult to gauge this factor. The addition of Filter Cel, however, entirely compensates for removal of bagacillo from cane juice.

Laboratory tests at the Hawaiian Commercial and Sugar Company's factory, showed that fine straining removed between 0·2 and 0·4 per cent. of dry suspended matter reckoned on the weight basis. Hence, for 100,000 tons of juice handled in a single season, 545 tons of ordinary moist megass were recovered, and a saving of some 800 dollars in oil fuel was thus effected. A reduction of 25 per cent. in weight of filter press cake also followed, with a concomitant saving of about 12 tons of sugar. The syrup was purer by 0·2 per cent., allowing a further recovery of sugar at the expense of the final molasses. Balancing the increased profits against cost of fine screens, depreciation, and other extra expenses, a possible net gain of some 6,000 dollars was indicated, and this was believed to be a sufficient margin to warrant further trials in the factory. Reports from several Hawaiian factories where fine straining was attempted, amply support this contention. Fine-straining would appear to be especially valuable for juice from muddy canes collected during rainy weather.

TRINIDAD COCOA.

[*We publish below a summary of the comments recently made by the German cacao periodical, "The Gordian," prompted by an article appearing above the name of Sir Francis Watts. We should be pleased to receive the views of planters and others on this subject, which is of vital interest to all concerned in the industry.*]

THE *Gordian* recently discussed an article by Sir Francis Watts on Cacao, and offered a number of comments of which the following is a summary.

No manufacturer can make good chocolate products from badly cured cacao, and the time has passed when only the cheapest chocolate was sold and but few manufacturers produced a superior quality chocolate. To-day European manufacturers are certainly willing to pay more for good, ripe, brown-breaking cacao beans, than for bad, unripe, hardcutting, purple coloured beans.

Referring to the formation in Trinidad of the Co-operative Society of Cocoa Producers the *Gordian* points out that for years the largest consuming countries have possessed organisations and associations which have, on the whole, failed to make clearly known to cacao planters their claims. If in Trinidad it is felt that more can be done for the industry by establishing an association, then Trinidad should take the lead. The *Gordian* has no doubt that all organisations would be prepared to co-operate in any movement to improve the quality of cacao beans.

The *Gordian* proceeds to state that it must be admitted that many cacao planters in the various producing countries do not know how to prepare their beans for the market. Trinidad cacao planters and merchants are ignorant of the fact that the customary methods of curing cacao in the Island are defective, and that European manufacturers have, during the past few years, regarded Trinidad cacao with less favour than before. A large proportion of Trinidad cacao reaches Europe half-ripe and unripe. The purple colour of the beans, the bitter and sour smell and taste of Trinidad cacao are to be condemned; they prove that the curing is faulty. The dancing of cacao for the purpose of polishing the beans is held to be unnecessary, useless, and merely for show, since, as is well-known, the shells are of no use in the cacao industry.

If Trinidad cacao planters would follow the instructions of the *Gordian* in curing their beans they would receive a better reward, expressed in higher prices, than they receive to-day. The following revised instructions were recently published in the *Gordian* for Ecuador cacao but apply equally to other kinds.

Ripe cacao alone should be picked. These ripe pods should be heaped together, opened, and the beans with adhering fruit-pulp collected. After the beans have been fermented in sweat boxes until the kernels have turned brown, any adhering fruit-pulp should be washed off, and the beans dried, in the sun if possible, or, if artificial heat is used, in a temperature not exceeding 40°-60°C.

Prior to bagging the cured beans should be graded according to ripeness and size. Fully ripe, thoroughly fermented, washed, well-dried beans are plump-round, with a reddish skin surrounding a loose, friable, dark-brown, mild-bitter, aromatic kernel. Such ripe beans are crisp, and, in cutting, the shiny brown kernels crumble. The large plump-brown beans from such lots of cacao, measuring 25 mm. long by 15 mm. wide, should alone be classed as "Superior." Unripe, badly fermented, unwashed, firm in cut, purple coloured beans, on the other hand, should never be termed or supplied as "Superior" cacao.

From the foregoing instructions, says the *Gordian*, the Trinidad cacao planter can see that the cacao industry places a higher value on washed, red-skinned cacao beans than on beans which are polished, as to-day, by dancing. There is no difficulty in defining clearly and distinctly how ripe, thoroughly fermented, washed, and then properly dried and cured cacao beans should look, smell and taste.

Cacao manufacturers would be very grateful to planters of every cacao variety and in each country if they would grow new superior varieties by grafting, but they would be quite contented if the varieties of to-day were fully ripe, thoroughly fermented, washed, and properly dried when put on the market. A regular intercourse between cacao manufacturers and cacao planters can only be beneficial to both.

The necessity of educating larger circles in the consumption of cacao products is evident all over the world, but the "strong man" must be discovered who will solve this task with skill and perseverance. In considering propaganda work and conferences it should be remembered that "too many cooks spoil the broth." To quote Tell, "The mighty is strongest when he has to rely on himself."

HORTICULTURAL CONFERENCE.

International Meeting in New York.

MR. J. P. GRIFFITH informs us that the Horticultural Society of New York has decided to hold an International Conference in New York City from August 9-16, 1926, when the subject to be considered will be "Flower and Fruit Sterility." The scope of the Conference will include a consideration of the phenomena of sterility and fertility in fruit and seed production with special reference to the breeding of floricultural plants, problems of fruit growing and seed production in horticultural and agricultural crops, and the botanical and genetical aspects of sterility and fertility. Further notices will be sent out from time to time.

REVIEW.

WEMBLEY in Colour, by Donald Maxwell, Longmans Green & Co., 1924, pp. 112. Price 21s. (N.B. New copies of this book can be obtained direct from the Times Book Club, 42, Wigmore Street, London, W.I., at 5s. per copy.)

Mr. Maxwell set out for Wembley armed with a sketch book and reinforced with a good lunch at the Stadium for the purpose of condensing the British Empire into a single handy volume. He eventually came away with over one hundred sketches in colour and monochrome which are presented in this little book. The contents are divided into five sections representing Africa, The Golden West, Lights of Asia, The Pacific Group, and Great Britain and Two Islands. The artist tells us that "frequently I have had to remind myself as I sketched that I was still in Old England." This is intended by the writer to "bear witness to the excellence of interpretation of many a scene overseas" but can equally well be used to compliment the artist, for no matter what scene he depicts, nor what medium he uses, he contrives by some subtle means to convey the *atmosphere* of the varied parts of the Empire. The letterpress is written in a light and attractive manner and makes very pleasant reading. At the ridiculously low price of 5s. per copy it should find a ready sale as a school prize and should prove equally attractive to those who have, and those who have not, seen Wembley in reality.

The Jamaica Tourist Trade Development Board, in a cable to Sir Oswald Stoll, suggested that if permanent sunshine is essential for the proper development of the British Film Industry, Jamaica's glorious climate can give 365 days of it every year. This, combined with scenic beauty and charm, would enable British producers to rival the productions of foreigners. Several important productions have recently been filmed in Jamaica.

The 1925 Tanganyika Territory Handbook (p. 37) states, "A knowledge of the general principles of sanitation and preventive medicine in the tropics, especially as applied to native settlements is of great value to settlers; and care spent on these matters is well repaid by a contented and efficient labour force." Every Student who passes through this College will, through the generosity of the International Health Board, follow a course in tropical sanitation and hygiene.

It has recently been announced that, with the passage of the Colonial Bank Bill, the Colonial Bank will be re-incorporated as the nucleus of an institution which, eventually, will give to the Empire the same sort of banking facilities as are enjoyed in every part of the Mother Country. Under the auspices of Barclay's Bank the Colonial Bank, the Anglo-Egyptian Bank, and the National Bank of South Africa are to be merged into one institution with the title of Barclay's Bank (Dominion, Colonial, and Overseas). The new Bank will have a capital of £10,000,000.

THE COLLEGE.

Report of the Governing Body for the year ended December 31st, 1924.

THE Governing Body in submitting their Third Annual Report, together with the Audited Statement of the Income and Expenditure Account for the year ended December 31st, 1924, and the Balance Sheet, desire to record their sense of the great loss which the Imperial College has sustained since the close of the year through the death of Viscount Milner, K.G., G.C.B., G.C.M.G., which took place on May 13th, 1925. From its inception Lord Milner was closely associated with the movement. As Secretary of State for the Colonies he appointed the Tropical Agricultural College Committee, whose recommendations led to the foundation of the College, and in 1923 he identified himself with the Appeal for Funds for the completion and equipment of the Buildings and Laboratories and for other purposes in connection therewith.

They have also to record their regret at the death of Mr. Claude Tinné Berthon, A.M.mst.C.E., their Honorary Consulting Engineer, which occurred on July 29th, 1925. Mr. Berthon not only designed and superintended the erection of the Instructional Sugar Factory at St. Augustine, but was also largely responsible for securing gifts of machinery and plant from the British Sugar Machinery Manufacturers and allied firms to the value of upwards of £20,000 towards its equipment. They feel that his services so ungrudgingly given will be greatly missed.

The year under review was marked by the retirement in November of Sir Francis Watts, the first Principal of the Imperial College of Tropical Agriculture and for fifteen years Imperial Commissioner of Agriculture for the West Indies. The Governing Body desire to record their deep appreciation of the valuable services rendered by Sir Francis Watts to tropical agriculture and especially in connection with the establishment of the College in which he took so prominent a part. In recognition of those services they appointed him on his retirement to the honorary position of Principal Emeritus of the College.

In May Dr. Hugh Martin Leake, M.A., SC.D., F.L.S., F.Z.S., Director of Agriculture United Provinces, India, and formerly Principal of the Agricultural College at Cawnpore, was appointed Principal in succession to Sir Francis Watts. Dr. Leake left for Trinidad on August 9th and took up his duties on arrival at St. Augustine, Sir Francis Watts having proceeded on leave pending retirement.

Mr. H. B. Walcott, C.M.G., on assuming the duties of Colonial Treasurer of Trinidad and Tobago, became *ex officio* a Member of the Governing Body pursuant to Article 7 (A), of the Articles of Association.

Mr. Cecil Yaxley Shephard, B.SC. (Econ.), was appointed Reader in Economics in August in succession to Professor W. R. Dunlop, who had resigned.

Professor S. F. Ashby, B.Sc., Professor of Mycology and Bacteriology, visited England to attend from July 2nd to 5th, Meetings of the Mycological Conference, at which he read a paper on the Panama Disease of Bananas.

The year opened with 18 Diploma Students and 6 Post-Graduates on the Register. By the close of the year the numbers were 18 Diploma Students and 14 Post-Graduates. The Governing Body regard this increase as satisfactory, showing as it does the growing appreciation of the advantage to be derived from the College Course.

The appeal for £100,000 to provide funds for the completion and equipment of the new buildings and laboratories and for other essential objects, to which reference was made in last report, was formally launched by Viscount Milner, K.G., G.C.B., G.C.M.G., on June 24th, when a letter signed by him was published in the Press. By the close of the year the contributions amounted to £21,083. While thanking the contributors the Governing Body also desire to express their indebtedness to the Empire Cotton Growing Corporation for extending their contribution of £500 for two years to the Colonial Research Committee for a vote of £300 towards the conduct of banana experiments.

His Excellency Sir Samuel Wilson, K.C.M.G., K.B.E., C.B., R.E., the then Governor of Trinidad and Tobago, laid, on January 14th, the Foundation Stone of the new Buildings and Laboratories, the work on which was continued throughout the year. Sir Arthur Shipley, Chairman of the Governing Body, Captain Arthur Hill, Director of the Royal Botanic Gardens, Kew, and a Governor of the College, and the Secretary were present, and subsequently proceeded to Jamaica, where they attended the Agricultural Conference held at Kingston from January 29th to 31st.

Sir Arthur Shipley and the Secretary visited British Guiana from January 7th to 10th, and through the courtesy of the then Governor, His Excellency Sir Graeme Thomson, K.C.B., were able to address a large public meeting at the Town Hall in Georgetown on the subject of the College and its work and aims. As a result the Combined Court of British Guiana subsequently voted an annual contribution of £1,000 towards the College Funds. Invited to nominate a Governor, pursuant to Article 7 (*b*) iii., they appointed Sir Edward Davson to represent them.

Early in the year work was begun on the erection of the Industrial Sugar Factory. It proceeded rapidly and was nearly completed at the close of the year. On their return from the West Indies Sir Arthur Shipley and Mr. Aspinall visited Baton Rouge to consult the well-known sugar expert, Professor C. E. Coates, of the State University of Louisiana, regarding the sugar course. They are very much indebted to Professor Coates for the valuable assistance which he gave them. Professor Overton Fuqua Boyd was in June appointed Sugar Technologist in charge of the Factory.

In January the first number of "*Tropical Agriculture*, the Journal of The Imperial College of Tropical Agriculture," was issued. The Journal was published monthly throughout the year, and the rapid increase in its circulation leads the Governing Body to believe that it is much appreciated and that it fills a useful purpose.

A work entitled "Diseases of Crops—Plants in the Lesser Antilles," by Mr. William Nowell, D.I.C., Assistant Director of Agriculture, Trinidad-Tobago, and late Mycologist on the Staff of the Imperial Department of Agriculture, was published during the year and was very favourably received.

Messrs. Smith and Earle were re-appointed Honorary Auditors and kindly continued to act in that capacity.

The Governing Body have been gratified to notice the increased interest taken in the College throughout the Empire, for the promotion of whose agricultural industries and trade it has been established. They feel confident that if the requisite financial support is forthcoming the College will play an important part through the channel of existing and the opening up of new sources of raw materials on which Great Britain is so vitally dependent.

A. E. SHIPLEY,
Chairman.
D. PRAIN,
Vice-Chairman.
ALGERNON ASPINALL,
Secretary.

14, Trinity Square,
E.C.3.

MALAYA.

ARISING out of an announcement that the International Health Board of the Rockefeller Foundation have taken Offices in Union Buildings, Singapore, the Local Press gives an interesting account of the activities of the foundation in Malaya.

It is stated that the history of its development goes back to the Far Eastern Congress of Tropical Medicine, held at Singapore in 1923, after which an official invitation was extended by the Government of the Straits Settlements to the Rockefeller Foundation to undertake work here, which invitation was accepted.

At present extensive and valuable work is being carried on by the Board in Siam in combating hookworm, and some 600,000 Siamese have been treated for this disease already. The work includes schools for training sanitary and health officers, intensive health centre work at Lopburi, and anti-hookworm campaigns in various parts of the country.

The Rockefeller Foundation is also co-operating with the Siamese Government in re-organising the medical school at Bangkok, and has now several visiting professors engaged in that work.—*Bulletin of the Rubber Growers Association.*

AGRICULTURAL CO-OPERATION.

"AGRICULTURAL CO-OPERATION IN THE BRITISH EMPIRE."—with an introduction by SIR HORACE PLUNKETT, K.C.V.O., F.R.S., &c., pp. 254. London: Geo. Routledge. 1925. Price 10*s*. 6*d*. net.

This book consists of a Report of a Conference on Agricultural Co-operation in the British Empire held at Wembley. The Report is preceded by an excellent introduction from the pen of Sir Horace Plunkett, K.C.V.O., F.R.S., and a valuable survey of agricultural co-operation in the Empire edited by Karl Walter. The origin of the Conference is worth recording. Sir Horace Plunkett, who has made agricultural co-operation his life-work, having achieved considerable success in organising agricultural co-operation in Ireland and elsewhere, has endowed a Trust named the Horace Plunkett Foundation for the purpose of consolidating and extending the work he has so successfully commenced. The British Empire Exhibition was seized as an opportunity for the holding of a Conference of Empire delegates to discuss problems and principles connected with the subject. The Slogan of the foundation is "Better Farming," "Better Business," "Better Living," of which "Better Business," in other words agricultural co-operation, forms the key to the whole problem.

Sir Daniel Hall, in a brief but admirable address, urged that while from the Government's point of view it was essential that the farmers should be co-operatively organised, the task of organising them must be left to voluntary agencies since it involves a propaganda which it is undesirable for a Government to undertake on account of its controversial nature. Further, to carry such propaganda to success it is essential to have that fervour of conviction and proselytising power which is rarely the characteristic of a Civil Servant.

Why has the co-operative movement met with such lack of success among farmers in the United Kingdom? The answers usually given are that the British farmer is rootedly conservative, intensely individualistic and distrustful. The typical farmer operates on a fairly large scale, does not produce for export, and is surrounded by an old established, organised and efficient trade service both for sale and purchase. A further and more important explanation may be advanced namely, the fact that they simply do not know how to co-operate. Everyone is more or less familiar with the joint stock company but few understand the wholly different principle, spirit, and technique of the co-operative society. The main lesson which the countryman has to learn is the *modus co-operandi*.

The conference marks an important stage in the history of agricultural co-operation. Much was accomplished in stating definite lines of policy, in the interchange of experiences, in discussing the peculiar needs of different countries and in other directions, but the main value of the Conference must be gauged in the light of its influence upon subsequent developments. In other words if the Conference be regarded as an end in itself it must be written down as a failure but if it is really the beginning of an organised development of agricultural co-operation it will have achieved something of prime constructive importance. Professor Adams, whose speech should be studied in detail, pleaded for the establishment of a clearing house of information for the Co-operative movement, in which connection the Trustees informed the Conference that they were prepared to do all they could, financially and otherwise in the initiation of the work. The following resolution was moved and carried:—

> "That in view of the importance and urgency of reliable information as to the position and progress of the agricultural Co-operative movement in all its branches there should be established in London a clearing house of such information for the service of the movement primarily throughout the English-speaking world.
>
> That the Trustees of the Horace Plunkett Foundation be hereby asked to consider steps to give effect to the above resolution."

Such a clearing house firmly established and functioning smoothly would assist in removing a justifiable reproach that co-operative societies do not co-operate, *i.e.*, among themselves. The benefits to be derived are too obvious to need recapitulation.

Little information is given concerning the Crown Colonies. pp. 96-97 give some slight indication of some of the work achieved in some of the Crown Colonies but the summary cannot be regarded as complete or particularly good. Agricultural Co-operation is, in the nature of things, backward in our Crown Colonies but not nearly so undeveloped as the resumé would indicate. The scope for agricultural co-operation in these areas is immense. Most Crown Colonies produce for purposes of export and the existing means of marketing cannot be described as highly organised or efficient in the majority of cases. The scope for joint purchase of agricultural requirements, the manufacture of agricultural produce, and the promotion of agricultural credit societies, among other features, are capable of considerable development. In addition to the absence of any adequate knowledge of the technique of co-operation there is an apparent lack of what, for the want of a better phrase, may be termed "co-operative urge." Experience has shown that it is useless to impose a co-operative system when that urge is lacking but whether the absence is apparent or real is a matter which would well repay investigation.

In conclusion it may be stated that the Conference is characterized by a refreshing breadth of outlook, and a ready appreciation of the difficulties to be encountered; characteristics which are usually absent from a gathering of enthusiasts. Those who believe in co-operation will derive fresh inspiration from this report, while many of those who do not believe in the co-operative movement will be converted.

C. Y. SHEPHARD.

COCOA NOTES.

Mr. H. Hamel-Smith, Editor of that popular periodical *Tropical Life*, has sent us an interesting communication in which he states that he has erroneously been accused of conducting a campaign for the purpose of benefiting West Indian and other cocoas at the expense of West African. He claims that, on the contrary, he has consistently maintained that the extended use of better cocoas will increase the demand for Accras. The demand for cocoa powder is small and shews little signs of increasing for the simple reason that the people don't like it and the producers have not endeavoured to manufacture a blend which they will like. He maintains, that had such a powder been placed on the market, the demand in America would have increased by 50 per cent. during the last eight years instead of remaining stationary. When the public's taste has adequately been catered for no one will benefit more than the West African cacao planter, since Accras are used as a base for blending with superior varieties. West African cacao sells to-day at a price which allows a substantial margin of profit for the producer but the better types, such as Bahias and Trinidads, are not receiving the premiums to which they are entitled. It has been suggested that African cacao, with low costs of production, will eventually kill out all better growths, but Mr. Hamel-Smith maintains that this can never be, since no one can sell an entirely unblended cocoa, particularly when the one growth is Native West African.

In a recent number of the *West India Committee Circular* there appeared a letter from Sir Hesketh Bell, now in Kashmir, relating to the origin of the great cacao industry in the Gold Coast. Sir Hesketh, like previous correspondents to the Circular, emphasizes that the birth of this industry was due to the foresight and initiative of Sir W. Brandford Griffith, then Governor of the Colony. At the time of Sir Hesketh Bell's visit in 1890 the prospects appeared none too promising. The Curator of the Agricultural Station at Aburi appears to have had little or no practical experience of tropical agriculture and had done nearly everything he should not have done in establishing the experimental cacao patch. The land selected was on a slope facing the prevailing wind and was without an atom of shade, with the result that the young trees became sickly-looking whips with hardly a sign of leaf on them. The Curator then in charge had become so convinced of the unsuitability of the climate that he intended to abandon the experiment. The enthusiastic Governor enlisted the aid of Sir Hesketh Bell who had had considerable experience with cacao in Grenada. A suitable piece of land was selected in a sheltered valley with adequate shade, first of a sort of *caladium*, and then of bananas. The trees throve admirably and a few years later, produced all the seeds that were distributed among the people of the Gold Coast and which finally resulted in making this country one of the greatest cacao-producing countries in the world.

COLLEGE NEWS.

Professor S. F. Ashby returned from vacational leave in England by the S.S. *Stuyvesant* on September 26th.

Mr. Walter Scott, B.Sc., Chemist of the Usine Ste. Madeleine, has been appointed to carry on the work of Sugar Technology this term.

Mr. W. H. Parratt has kindly consented to act as Honorary Consulting Engineer for the Instructional and Experimental Sugar Factory of the College.

Miss Nellie Hamel-Smith, who successfully manages an estate in Tobago, visited the College and discussed the opportunities of women in tropical agriculture.

Mr. E. E. Cheesman, B.Sc., A.R.C.S., and Mr. P. E. Turner, B.Sc., left Trinidad on September 15th to pay a short visit to Barbados. They returned on September 22nd.

Mr. Eugene Ramsden, M.P., accompanied by Mrs. Ramsden, visited the College on September 12th and several subsequent dates and discussed various matters of College interest with the Principal and members of the Staff.

Mr. P. D. R. Bovell, student 1922-25, has taken up the management of an estate in Jamaica.

Mr. S. C. Littlepage, student 1922-25, has been appointed as an Overseer on Caroni Estate, Trinidad.

Mr. C. Holman B. Williams, Diploma Student of 1922-25, has been appointed Agronomist at the Agricultural Station, Pointe-a-Pitre, Guadeloupe.

Mr. S. H. Evelyn, student 1922-25, who secured his Diploma in 1925, has been appointed, provisionally, 3rd Field Assistant, Department of Agriculture, Barbados.

Mr. B. G. Montserin, student 1922-25, has gone to take a course at the MacDonald College, Canada. Mr. Montserin was Field Assistant to the Botany Department during the vacation.

Mr. J. L. Illingworth, B.A., Post-Graduate student 1924-25, has been appointed Overseer at Caura, Trinidad.

Captain W. C. Lester-Smith, B.A. (Agric.), Post-Graduate student at the College during the session 1924-25, has been appointed an Inspector of Diseases and Pests in Ceylon.

Mr. R. P. Follet-Smith, B.Sc. (Lond.), Post Graduate student 1924-25, has been appointed Assistant Chemist at the Usine Ste. Madeleine, Trinidad, but is returning for another term for sugar technology.

Messrs. F. A. Robb, B.Sc., N.D.A., J. C. Muir, B.Sc., N.D.A., N.D.D., B. T. Steemson, B.A., and W. T. O. Maidment, B.A., Post-Graduate students 1924-25, will take up appointments as Assistant Superintendents of Agriculture, Department of Agriculture, Gold Coast.

Session 1925-26 commenced on Thursday, October 1st, 1925. The following Students are taking the Diploma Course :

1st Year.—Messrs. L. S. Birkett and G. E. L. Spencer (Barbados) ; Messrs. F. McG. Bain and R. O'Reilly (Trinidad) ; Mr. A. J. Waterfield (British Guiana) ; Messrs. W. A. Archer and A. C. G. Palmer (St. Lucia), and Mr. W. B. Jacobs (Grenada).

2nd Year.—Messrs. L. A. Blanc and J. A. Potter (Trinidad) ; Mr. J. A. MacDonald (Antigua); Mr. R. M. Stevens (St. Vincent).

3rd Year.—Mr. J. G. Davies (England) ; Mr. H. B. Springer (Barbados) ; and Mr. H. D. Huggins (Nevis).

4th Year.—Mr. A. H. McKinstry (Barbados) and Mr. V. I. Mulloon (Trinidad). Mr. McKinstry will also be Field Assistant to the Botany Department of the College.

The following Students are taking Post-Graduate and Special Courses : Messrs. E. R. Guest, J. C. Haigh, F. E. Kenchington, J. V. Lochrie, H. G. Miller, C. F. van Rooyen. and S. R. de Villiers, all from the Empire Cotton Growing Corporation. Mr. B. G Owen, probationer from the Colonial Office ; Mr. A. Rifat, sent out by the Egyptian Government ; and Messrs. H. C. L. Bulwer, M. Aspiazu, D. C. T. Cotton, C. A. Milne Home and D. D. Haynes.

Mr. E. R. Guest was educated at Eton and the Royal College of Science (London). In 1923 he secured the A.R.C.S., and in 1924 B.Sc. honours at London University. Recently he has been studying at the South-Eastern Agricultural College, Wye.

Mr. J. C. Haigh was educated at the Central Secondary School, Sheffield and the Imperial College of Science and Technology, London. He obtained his A.R.C.S. in 1923 and his B.Sc. honours, London, in 1924. He proposes to specialise in Pathology and Genetics while at the College.

Mr. F. E. Kenchington was educated at Harvey School, Folkestone, the South-Eastern Agricultural College, Wye, and St. John's College, Cambridge. He passed B.Sc. (Agric.), London in 1923, and secured a diploma in Science and Practice of Agriculture from the Agricultural College, Wye. He will specialise in Genetics.

Mr. H. G. Miller was educated at Dundee High School. He took his B.Sc. (Agric.) at Edinburgh in 1924, and will specialise in the administrative and practical side of cotton growing while at the College.

Mr. J. V. Lochrie was educated at Ewart High School, Wigtownshire, and secured his B.Sc. (Agric.) at Glasgow University in 1923. He also holds the N.D.A. and N.D.D. Mr. Lochrie served with His Majesty's Forces during the War.

Mr. S. R. de Villiers was educated at the Transvaal University College where he obtained his B.Sc. (Agric.) in 1923, and has since been Assistant in the Tobacco and Cotton Division, preparing a thesis for the M.Sc. (Agric.). He will specialise in plant breeding.

Mr. C. F. van Rooyen was educated at the Transvaal University College, where he obtained the B.Sc. (Agric.). He has been Assistant in the Tobacco and Cotton Division, where he has been engaged in cotton research for the M.Sc. degree of the University of South Africa. He will make a special study of cotton breeding.

Mr. B. G. Owen was educated at Berkhamsted School, Herts., and Cambridge University, where he obtained the B.A. in estate management and 1st class honours in the final Cambridge diploma in agriculture.

Mr. H. C. E. Bulwer was educated at Grootfontein Agricultural College, South Africa, where he matriculated and obtained his diploma in Agriculture. He has recently been a demonstrator in animal husbandry. He will make a special study of cotton, sugar and tobacco.

Mr. A. Rifat was educated in Cairo and St. Andrew's University, Scotland. He holds the B.Sc. with 1st class honours in Botany, and for a time acted as assistant lecturer in Botany during the illness of a member of the Staff. He will make a special study of cotton, in preparation for work with the Ministry of Agriculture, Egypt.

Mr. C. A. Milne Home was educated at St. Mary's School, Melrose, Scotland, Haileybury College, King's College, Cambridge, and Edinburgh University. He is an M.A., LL.B. of Cambridge University and will take a special course at the College.

Messrs. M. Aspiazu and D. D. Haynes, who took special courses at the College during the Session 1924-25 have returned to follow additional courses.

The following students have since arrived at the College to take Post-Graduate or Special courses. Messrs. V. M. Hinchy, R. F. Follet-Smith, J. E. James, L. C. C. Liebenberg and B. G. Owen.

Mr. V. M. Hinchy, M.Sc., A.I.C., was educated at Queens University, Galway and Belfast University College. He is at present Chemist at the Caroni Estate, Trinidad, and will take the College course in Sugar Technology.

Mr. R. R. Follet-Smith, B.Sc., A.R.C.S., Post-Graduate Student 1924-25, is at present Assistant Chemist at the Usine Ste. Madeleine, Trinidad. He has returned to take a further course in Sugar Technology.

Mr. J. E. James, B.Sc., was educated at the University College of Wales, and at Oxford. He has been sent out by the Colonial Office to take a Post-Graduate course at the College.

Mr. L. C. C. Liebenberg, B.Sc. (Agric.) of Transvaal University College, Pretoria, and M.S.A. of McGill University, will take a Post-Graduate course at the College.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—No encouraging features were apparent in the market during the last month and apart from English refined all types have shown a tendency to decline. Cubes remain at 35*s*. Best granulated declined to 28*s*. 9*d*., West Indian Crystallized to 26*s*. 3*d*., and Muscovado to 21*s*. 3*d*., each per cwt., duty paid, on September 16th. The new Cuban crop has been estimated by the Washington Bureau at 5,310,000 tons. Consumption in the United Kingdom for the first 8 months of 1925 is reported at 1,125,550 tons as against 1,071,620 tons in 1924.

COTTON.—Weather continues to be the dominant factor in the cotton market. The report of the Bureau to be published on September 23rd was expected to show a further reduction in indicated crop but estimates varied widely as to how great the reduction would be. Mid-American closed at 13·63*d*. per lb. on September 16th.

CACAO.—The last month has been a quiet one both manufacturers and dealers showing little interest. On the other hand the undertone has remained firm and there has been no pressure to sell. Prices closed on September 16th at 105*s*. for Ceylon Ordinary, 77*s*. 6*d*. for Trinidad Mid-Red, 67*s*. 6*d*. for Grenada Fine, and 43*s*. 9*d*. for Accra Fermented, each per cwt. It is reported that 30,000 lb. of cacao valued at $400,000 was sold on the floor of the New York Cocoa Exchange on October 1st, the first day of operation.

COFFEE.—The market has improved in tone during the past month and there has been a good demand for the better qualities, particularly good Costa Rica. The available supplies of the finer coffees are being rapidly reduced. Finest quality Blue Mountain Jamaica has been sold at 201*s*. per cwt. Prices on September 16th included Costa Rica Middling at 168*s*., East Indian Mysore at 134*s*., Kenya Good Middling at 126*s*., and Brazil Santos at 102*s*., each per cwt. The European stock of coffee on September 1st was estimated at 1,602,000 bags compared with 1,421,000 bags in 1924, and the total visible supplies at 5,237,000 bags against 5,287,000 bags a year ago.

TEA.—Further declines have been experienced in tea though there was a tendency to recover during the second week in September. Averages on September 16th were: Ceylon 17·90*d*., Indian 14·50*d*. and Java 11·29*d*., each per lb.

SISAL AND HEMP.—Sisal sold at £45 10*s*. per ton and Manila Hemp at £44 on September 16th. There is a tendency for Hemp to move in buyers' favour.

RUBBER.—Considerable fluctuations have again been experienced. Spot Ribbed Smoked Sheet sold at 3*s*. 6½*d*. and Crepe at 3*s*. 5¾*d*. on September 24th. During the week ending September 19th 2,010 tons were imported at London and 2,477 tons delivered, leaving a stock of 5,232 tons.

COPRA.—Sales are reported to be quite good, and included, on September 16th, F.A.Q. Ceylon to London at £31 10*s*. Sun-dried Straits to Rotterdam at £30 12*s*. 1*d*. and Straits to Marseilles at £30, each per ton.

PALM KERNELS.—Great stability has now been attained in palm kernels as a trade and the spot price of 21*s*. 9*d*. per cwt. is taken and obtainable or all sales to the end of December.

GROUND-NUTS.—Prices on September 16th included Nigerian at £25, Indian at £24 and Senegal at £19 10*s*., each per ton.

FERTILIZERS.—Fertilizers have shown a tendency to advance in price particularly Muriate of Potash which advanced from 7*s*. 3*d*. per cwt. on August 16th to 9*s*. 3*d*. on September 16th; and Nitrate of Soda at 13*s*., Sulphate of Ammonia at 12*s*. 6*d*. and Sulphate of Potash at 11*s*. 6*d*. each per cwt.

SPICES.—Mace is unchanged at 3*s*. 9*d*. to 4*s*. 2*d*. for broken to good palish bold. Nutmegs show little change, sound unassorted realising 1*s*. 11*d*. per lb. Jamaica ginger continues to meet a very limited demand at from 80*s*. to 120*s*. for common small to fine bold quality. Pimento has attracted considerable attention during the past month. First-hand holdings on the spot seem to be entirely exhausted. September-October shipment was quoted at 45*s*. c.i.f.

THE "PORT-OF-SPAIN GAZETTE."

Few newspapers in any part of the world can claim to have had a continuous publication extending over a period of 100 years. To the select band of centenarians has recently been added the *Port-of-Spain Gazette*, the first issue of which appeared on September 21st, 1825. To this newspaper belongs the honour of being the only West Indian journal to have survived this long period. On September 21st, 1925, the *Gazette* published an illuminating Centenary number which, in addition to an editorial survey and a historical review of the period by Thomas Beddard Jackson, contains extracts from the *Trinidad Gazette* and its successor, the *Port-of-Spain Gazette*, for nearly every year from 1821 to the present year, thus giving in a concise form an excellent history of this Colony under British rule. From its earliest days the *Gazette* enjoyed a reputation for frankness which occasionally brought it into conflict with the ruling authority so that in 1833, for example, we find the proprietors, Mills and Stewart, writing from the Royal Gaol, wherein they were incarcerated under an execution for debt following an expensive libel action. This incident, but one of many, the *Gazette* happily survived, remaining as vigorous in its outlook as in the stormy days one hundred years ago. We note, with pleasure, that the Editor proposes to publish extracts from time to time under the heading, "One Hundred Years Ago."

LORD MILNER'S APPEAL.

[*The following is the Second List of Contributions towards the Late Lord Milner's Appeal for £100,000 on behalf of the Imperial College of Tropical Agriculture. Later contributions will be published in subsequent issues of "Tropical Agriculture."*]

	£	s.	d.
THE LIVERPOOL COTTON ASSOCIATION, LTD.	1,000	0	0
THE FELLOWSHIP OF THE BRITISH EMPIRE EXHIBITION	500	0	0
MESSRS. CADBURY BROS., LTD.	500	0	0
THE CHILEAN NITRATE COMMITTEE	262	10	0
MESSRS. LEVER BROS., LTD.	200	0	0
MESSRS. COURTAULDS, LTD.	200	0	0
THE JOHANNESBURG CONSOLIDATED INVESTMENT CO., LTD.	105	0	0
MESSRS. TATE AND LYLE, LTD.	105	0	0
THE NOBEL INDUSTRIES, LTD.	105	0	0
W. D. GRAHAM MENZIES, ESQ.	100	0	0
THE FORESTAL LAND, TIMBER AND RAILWAYS CO., LTD.	100	0	0
THE TRINIDAD ELECTRIC CO., LTD.	100	0	0
E. & S. CO-OPERATIVE WHOLESALE SOCIETY, LTD.	100	0	0
A. J. ANDERSON, ESQ.	100	0	0
MESSRS. EDWARD BOUSTEAD & CO.	52	10	0
MESSRS. REYNOLDS & GIBSON	52	10	0
MESSRS. JOHNSEN, JORGENSEN & WETTRE, LTD.	52	10	0
J. FRANCIS MASON, ESQ.	50	0	0
MESSRS. WILLIS, FABER & CO., LTD.	50	0	0
SIR JOHN ELLERMAN, BT. C.H.	50	0	0
THE MOST HON. THE MARQUIS OF CREWE, K.G.	50	0	0
COLONEL J. A. ROXBURGH	50	0	0
MESSRS. KLEINWORT, SONS & CO.	50	0	0
SIR JOSEPH FLAVELLE, BT.	50	0	0
MESSRS. ANDERSON, WRIGHT & CO.	50	0	0
MESSRS. BROWN, SHIPLEY & CO.	26	5	0
THE KERN TRINIDAD OILFIELDS, LTD.	26	5	0
THE EASTERN PRODUCE & ESTATES CO., LTD.	26	5	0
C. V. SALE, ESQ.	26	5	0
MESSRS. BECKER & CO. (1924), LTD.	25	0	0
COLONEL E. J. HARRISON	25	0	0
HUGO HIRST, ESQ.	25	0	0
J. JORGENSEN, ESQ.	21	0	0
SIR BASIL ZAHAROFF, G.C.B., G.B.E.	21	0	0
MIDDLETON BECKETT, ESQ.	20	0	0
HENRY BUBB, ESQ.	20	0	0
THE RT. HON. EARL BUXTON, G.C.M.G.	20	0	0
HIS GRACE THE DUKE OF MARLBOROUGH	20	0	0
THE HON. SIR GEORGE H. PERLEY, K.C.M.G.	20	0	0
SIR JEREMIAH COLMAN, BT.	20	0	0
THE WEST INDIAN ASSOCIATION OF LIVERPOOL	10	10	0
THE NORTHSIDE PLANTERS & TRELAWNY PENKEEPERS ASSOCIATION	10	10	0
THE HON. GEORGE FAIRBAIRN	10	10	0
THE LORD MAYOR OF LONDON	10	10	0
CHARLES F. WOOD, ESQ.	10	10	0
CAPT. D. P. SIMSON	10	10	0
MESSRS. W. & R. JACOB & CO., LTD.	10	0	0
MESSRS. BROWN & POLSON	10	0	0
SUMNERS' TYPHOO TEA CO., LTD.	10	0	0
THE DECCAN SUGAR COMPANY	10	0	0
Carried forward	£4,480	0	0

	£	s.	d.
Brought forward	4,480	0	0
DR. A. E. WYNTER (Additional)	10	0	0
THE RT. HON. EARL FORTESCUE	10	0	0
SIR GEORGE SUTHERLAND	10	0	0
A. L. MUMM, ESQ.	10	0	0
GEORGE A. MITCHELL, ESQ.	10	0	0
MESSRS. H. BRONNERT & CO.	5	5	0
THE BRITISH EMPIRE STEEL PRODUCTS CO., LTD.	5	5	0
THE BRITISH EMPIRE LEAGUE	5	5	0
MESSRS. THOMAS HEDLEY & CO., LTD.	5	5	0
H. E. SIR DONALD CAMERON	5	5	0
H. B. FIGGIS, ESQ.	5	5	0
THE RT. HON. LORD SOUTHBOROUGH	5	5	0
A. S. WATT, ESQ., C.B.E.	5	5	0
A. L. REA, ESQ.	5	5	0
HIS GRACE THE DUKE OF SUTHERLAND	5	5	0
SIR WALTER EGERTON	5	5	0
P. G. ROUSE, ESQ. (Additional)	5	0	0
MELVILLE GRAY, ESQ.	5	0	0
BRIG.-GENERAL BLACKDEN	5	0	0
W. C. NOXON, ESQ.	5	0	0
A. E. SEWARD, ESQ., F.R.S.	5	0	0
WESLEY SMITH, ESQ.	5	6	0
ALGERNON ASPINALL, ESQ., C.M.G.	5	0	0
NOEL DEERR, ESQ.	5	0	0
E. P. HENDERSON, LTD.	3	3	0
THE RT. HON. THE EARL OF MEATH	3	3	0
SIR WILLIAM GREY WILSON	2	2	0
C. H. P. HAY, ESQ.	2	2	0
R. N. HOOPER, ESQ.	2	2	0
SIR HENRY GALWAY	2	0	0
SIR WILFRED COLLET	2	0	0
E. HEDGMAN, ESQ.	2	2	0
MESSRS. R. SILCOCK & SONS, LTD.	1	1	0
A. P. EDGCUMBE, ESQ.	1	1	0
SIR JAMES MICHELLI, C.M.G.	1	1	0
E. R. P. MOON, ESQ.	1	1	0
C. S. ROGERS, ESQ.	1	1	0
J. CONNELL, SENIOR	1	0	10
W. C. MACREADY, ESQ.	1	0	0
HIS HONOUR MAJOR J. A. BURDON	1	0	0
P. L. GUPPY	1	0	0
SIR GODFREY LAGDEN	1	0	0
THE RT. HON. LORD LEIGH	1	0	0
F. H. PADWICK, ESQ.	1	0	0
SIR FRANCIS YOUNGHUSBAND	1	0	0
J. L. LUDDINGTON		10	0
K. S. ARNOLD, ESQ.		10	0
E. CRUICKSHANK, ESQ.		10	0
INTEREST	200	11	2
	£4,862	2	0
PREVIOUS LIST	21,816	0	0
TOTAL (27/7/25)	£26,678	2	0

THE COLLEGE SUGAR FACTORY.

LIST OF FIRMS WHO GAVE CONCESSIONS IN PRICES OF EQUIPMENT FOR INSTRUCTIONAL FACTORY, TRINIDAD.

COMPILED BY THE LATE CLAUDE T. BERTHON, A.M.I.C.E.

Firm.	*Equipment Supplied.*
AITON & CO., LTD.	High Pressure Steam Piping.
WILLIAM BARTON & SON	"Kongrip" Fittings for Pipes.
F. BRABY & CO., LTD.	Sheets for Boiler House.
I. BRATHWAITE & CO., LTD.	Bag Washing Machine.
CROFTS (ENGINEERS), LTD.	Shafting and Reducing Gear.
DERMATINE CO., LTD.	Washing-down hose.
S. DIXON & SON, LTD.	Gun-metal Cocks.
KONIFILM SPRAY COOLING CO.	Spray Nozzles.
LANCASHIRE DYNAMO & MOTOR CO., LTD.	Main Dynamo and Rheostat.
LOUDON BROS., LTD.	Tools.
A. & J. MAIN & CO., LTD.	Steel Building.
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MIRRLEES WATSON, CO., LTD.	Cane Carrier Fittings.
MURRAY, MCVINNIE & CO., LTD.	"Typhoon" Blower for Megass Furnace.
NEWALL'S INSULATION CO., LTD.	Pipe Covering.
NICHOLS PUMP & ENGINEERING CO., LTD.	Calandria and Syrup Pumps.
NORTHERN MANUFACTURING CO., LTD.	Reducing Gear for Economiser.
PETTERS, LTD.	Internal Combustion Electric Set.
H. POOLEY & SON, LTD.	Cart Weighbridge.
ROYLES, LTD.	Vacuum Traps.
SCOTTISH TUBE CO., LTD.	Wrought Iron Piping.
SUGAR MACHINERY MANUFACTURING CO., LTD.	Sulphuring Apparatus.
WESTWOOD & WRIGHTS	Liming Tanks, Sulphitor bodies, Chimney.
WHIPP & BOURNE, LTD.	Switchboard and Distribution Boxes.